TOOELE
ARMY
DEPOT

FINAL

CORRECTIVE MEASURES STUDY REPORT
GROUP A SUSPECTED RELEASES SWMUs
TOOELE ARMY DEPOT
TOOELE, UTAH

Contract No. DACA31-94-D-0060
Delivery Order No. 1

Prepared for:

TOOELE ARMY DEPOT
Tooele, Utah

Prepared by:

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APPROVED FOR PUBLIC RELEASE

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TABLES

ACRONYMS AND ABBREVIATIONS

AED	Ammunition Engineering Directorate
AEHA	U.S. Army Environmental Hygiene Agency
bgs	Below ground surface
BRAC	Base Realignment and Closure
CAMU	Corrective action management unit
CAO	Corrective action objective
CAP	Corrective Action Permit
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMS	Corrective Measures Study
COC	Contaminant of concern
COPC	Contaminant of potential concern
CWP	Contaminated waste processor
2,4-DNT	2,4-Dinitrotoluene
DCD	Deseret Chemical Depot
DDE	Dichloro-diphenyl-dichloroethylene
DOT	Dichloro-diphenyl-trichloroethane
DDT	U.S. Department of Transportation
DRMO	Defense Reutilization and Marketing Office
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
EPIC	Environmental Photographic Interpretation Center
FFA	Federal Facility Agreement
FRTR	Federal Remediation Technologies Roundtable
ft^2	Square foot
HI	Hazard index
HxCDD	Hexachlorodibenzo-p-dioxin

ACRONYMS AND ABBREVIATIONS (cont'd)

IRDMIS	Installation Restoration Data Management Information System
IRP	Installation Restoration Program
IWL	Industrial Waste Lagoon
LDR	Land disposal restriction
µg/dL	Micrograms per deciliter
µg/g	Micrograms per gram
NPL	National Priorities List
O&M	Operation and maintenance
OSC	Operations Support Command
OSHA	Occupational Safety and Health Administration
OU	Operable unit
PCP	Pentachlorophenol
RA	Risk assessment
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylenetrinitramine
RFI	RCRA Facility Investigation
SVOC	Semivolatile organic compound
SWERA	Sitewide Ecological Risk Assessment
SWMU	Solid waste management unit
TCLP	Toxicity characteristic leaching procedure
TEAD	Tooele Army Depot
TEAD-N	Tooele Army Depot - North Area
TEAD-S	Tooele Army Depot - South Area
TECA	Tooele Chemical Activity
TSDF	Treatment, storage, and disposal facility
UAC	Utah Administrative Code
UDEQ	Utah Department of Environmental Quality
USAEC	U.S. Army Environmental Center (formerly USATHAMA)
USAEHA	U.S. Army Environmental Hygiene Agency

ACRONYMS AND ABBREVIATIONS (cont'd)

USATHAMA	U.S. Army Toxic and Hazardous Materials Agency (now USAEC)
UXO	Unexploded ordnance
VOC	Volatile organic compound
yd^3	Cubic yard

EXECUTIVE SUMMARY

This document is the Corrective Measures Study (CMS) Report for the Group A Suspected Releases Solid Waste Management Units (SWMUs) at Tooele Army Depot (TEAD; formerly the North Area), Tooele, Utah. It has been prepared for TEAD, in association with the U.S. Army Environmental Center (USAEC), in accordance with the Resource Conservation and Recovery Act (RCRA) Corrective Action Permit (CAP; UT3213820894) issued to TEAD by the State of Utah.

The purpose of the CMS Report is to recommend a corrective measures alternative:

- For each SWMU for which the baseline risk assessment (RA) determined a significant threat to human health under the hypothetical future residential land use scenario.

  – or –

- For each SWMU that poses a threat to the environment.

According to the State of Utah Administrative Code (UAC; Regulation 315-101-6(c)3), a site management plan must be prepared for SWMUs that pose a human health cancer risk greater than 1×10^{-6}, a noncancer hazard index (HI) greater than 1.0, or a modeled blood lead level greater than 10 micrograms per deciliter (µg/dL) under the future residential land use scenario. The requirement for a site management plan is fulfilled by the CMS Work Plan and this CMS Report.

For SWMUs that do not pose a significant threat to human health or the environment under current (or likely future) land use conditions, the CMS may evaluate management measures such as land use restrictions. Alternatively, for SWMUs that do pose a significant risk to human health or the environment under current (or likely future) land use conditions, the CMS must evaluate active corrective measures (i.e., treatment technologies), which may also include management measures.

The CMS Report presents a detailed evaluation of the corrective measures alternatives developed in the CMS Work Plan (Dames & Moore, 2000) for the management of identified risks at the following nine Group A SWMUs:

- SWMU 1b – Burn Pad.
- SWMU 1c – Trash Burn Pits.
- SWMU 20 – Ammunition Engineering Directorate (AED) Deactivation Furnace Site.

- SWMU 21 – Deactivation Furnace Building.

- SWMU 34 – Pesticide Handling and Storage Area.

- SWMU 37 – Contaminated Waste Processing Plant.

- SWMU 42 – Bomb Washout Building.

- SWMU 45 – Stormwater Discharge Area.

- SWMU 48 – Old Dispensary Discharge - Building 400.

Two other Group A SWMUs – Main Demolition Area (SWMU 1) and Propellant Burn Pans (SWMU 1d) – are not addressed in this report. They currently operate with interim status under a RCRA Part B permit application. Further environmental sampling at these sites was deferred by U.S. Army and regulatory personnel pending future RCRA closure activities.

The CMS Work Plan (Dames & Moore, 2000) identified potential corrective measures alternatives for each of the SWMUs that were determined to pose a human health or environmental risk. This was accomplished by developing corrective action objectives (CAOs) for the contaminants of potential concern (COPCs) in the various media under the assumed future land use scenarios. The CAOs developed in the CMS Work Plan included quantitative risk-based objectives and qualitative, regulatory-driven objectives. COPCs were compared to quantitative CAOs to identify contaminants of concern (COCs). The CMS Work Plan identified corrective measures – which may include treatment technologies or management measures – that meet the qualitative and quantitative CAOs, and assembled them into corrective measures alternatives.

The following corrective measures alternatives are considered for the Group A SWMUs:

- SWMU 1b – Burn Pad

  – Land use restrictions.

- SWMU 1c – Trash Burn Pits

  – Land use restrictions.

- SWMU 20 – AED Deactivation Furnace Site

  – Land use restrictions
  – Asphalt cover and land use restrictions
  – Excavation, solidification/stabilization, and land use restrictions
  – Excavation, soil washing, and land use restrictions

- Excavation, off-post treatment/disposal, and land use restrictions.

- SWMU 21 – Deactivation Furnace Building

  - Asphalt cover and land use restrictions
  - Excavation, solidification/stabilization, and land use restrictions
  - Excavation, soil washing, and land use restrictions
  - Excavation, off-post treatment/disposal, and land use restrictions.

- SWMU 34 – Pesticide Handling and Storage Area

  - Land use restrictions
  - Soil cover, fence, and land use restrictions
  - Excavation, off-post treatment/disposal, and land use restrictions.

- SWMU 37 – Contaminated Waste Processing Plant

  - Land use restrictions.

- SWMU 42 – Bomb Washout Building

  - Soil cover, fence, and land use restrictions
  - Excavation, solidification/stabilization, and land use restrictions
  - Excavation, soil washing, and land use restrictions
  - Excavation, off-post treatment/disposal, and land use restrictions.

- SWMU 45 – Stormwater Discharge Area

  - Land use restrictions.

- SWMU 48 – Old Dispensary - Building 400

  - Land use restrictions.

The detailed evaluation of each corrective measures alternative considers technical criteria (including performance, reliability, implementability, and safety), protection of human health, environmental assessment, administrative feasibility, and cost, as outlined below:

- <u>Technical criteria</u>

  - <u>Performance</u> – Evaluates the ability of the alternative to perform its intended function and to meet the CAOs developed in the CMS Work Plan (Dames & Moore, 2000). Factors affecting performance – including site and waste characteristics – are also considered, along with the length of time the alternative maintains its intended level of effectiveness.

  – Reliability – Describes the long-term effectiveness and permanence of each alternative, and evaluates the adequacy of the treatment technology based on performance at similar sites, operation and maintenance (O&M) requirements, long-term environmental monitoring needs, and residuals management requirements.

  – Implementability – Assesses the technical and institutional feasibility of executing an alternative, including constructability, permit and legal/ regulatory requirements, and availability of materials. This criterion also addresses the length of time from implementation of the alternative until beneficial effects are realized.

  – Safety – Considers potential threats to workers, off-post residential communities, and the environment during implementation of the corrective measure.

- Human health assessment – Evaluates the extent to which each alternative protects human health. This criterion considers the classes and concentrations of contaminants left onsite, potential exposure routes, and potentially affected populations. Residual contaminant concentrations are compared to existing criteria, standards, and guidelines.

- Environmental assessment – Evaluates short- and long-term effects of the corrective measure on the environment, including adverse impacts to environmentally sensitive areas.

- Administrative feasibility – Considers compliance with applicable Federal, State, and local environmental and public health standards, requirements, criteria, or limitations.

- Cost – Considers capital and annual O&M costs for each alternative.

Based on the detailed evaluations conducted in this CMS, the ***recommended corrective measures alternatives*** for each SWMU are as follows:

- Land use restrictions at the Burn Pad (SWMU 1b).

- Land use restrictions at the Trash Burn Pits (SWMU 1c).

- Asphalt cover and land use restrictions at the AED Deactivation Furnace Site (SWMU 20).

- Asphalt cover and land use restrictions at the Deactivation Furnace Building (SWMU 21).

- Excavation, off-post treatment/disposal, and land use restrictions at the Pesticide Handling and Storage Area (SWMU 34).

- Land use restrictions at the Contaminated Waste Processing Plant (SWMU 37).

- Soil cover, fence, and land use restrictions at the Bomb Washout Building (SWMU 42).

- Land use restrictions at the Stormwater Discharge Area (SWMU 45).

- Land use restrictions at the Old Dispensary Discharge - Building 400 (SWMU 48).

Table ES-1 summarizes the corrective measures alternatives evaluated in the CMS for the Group A SWMUs; also included are summaries of the results of the human health and ecological RAs, potential effects on groundwater, and identified COCs.

TABLE ES-1
Summary of Corrective Measures Alternatives
Group A SWMUs

SWMU	Results of Human Health RA (a)						Results of Ecological RA (b)	Potential Effect on Ground-water?	COC (c)	Corrective Measures Alternatives (d)
	Military			Construction Worker						
	Cancer Risk	HI	Blood Lead	Cancer Risk	HI	Blood Lead				
Burn Pad (SWMU 1b)	2×10^{-7}	4×10^{-4}	3.4	2×10^{-7}	0.04	3.5	Low risk	No	None	***Land use restrictions ($12,000)***
Trash Burn Pits (SWMU 1c)	1×10^{-6}	0.03	3.5	1×10^{-6}	3.0	4.2	Low risk	No	Metals, explosives	***Land use restrictions ($12,000)*** (e)
Ammunition Engineering Directorate (AED) Deactivation Furnace Site (SWMU 20)	9×10^{-7}	0.2	5.8	7×10^{-7}	0.2	5.3	Moderate risk	No	Metals	Land use restrictions ($12,000) ***Asphalt cover and land use restrictions ($130,000) (f)*** Excavation, solidification/stabilization, and land use restrictions ($270,000) (f) Excavation, soil washing, and land use restrictions ($280,000) (f) Excavation, off-post treatment/disposal, and land use restrictions ($200,000) (f)
Deactivation Furnace Building (SWMU 21)	1×10^{-5}	3.0	35	6×10^{-6}	10	55	Potentially unaccept-able risk	No	Metals, dioxins/ furans, HxCDDs	***Asphalt cover and land use restrictions ($230,000) (f)*** Excavation, solidification/stabilization, and land use restrictions ($480,000) (f) Excavation, soil washing, and land use restrictions ($550,000) (f) Excavation, off-post treatment/disposal, and land use restrictions ($560,000) (f)
Pesticide Handling and Storage Area (SWMU 34)	1×10^{-5}	0.2	3.7	1×10^{-6}	0.2	3.6	Low risk	No	Metals, pesticides	Land use restrictions ($12,000) Soil cover, fence, and land use restrictions ($43,000) ***Excavation, off-post treatment/disposal, and land use restrictions ($63,000)***
Contaminated Waste Processing Plant (SWMU 37)	1×10^{-5}	0.002	NE (g)	6×10^{-7}	0.006	NE	Moderate risk	No	SVOCs, dioxins/ furans	***Land use restrictions ($12,000)*** (e)
Bomb Washout Building (SWMU 42)	2×10^{-6}	3.0	18.1	3×10^{-6}	4.0	16.2	Potentially unaccept-able risk	No	Metals, explosives, dioxins/furans	***Soil cover, fence, and land use restrictions ($520,000) (f)*** Excavation, solidification/stabilization, and land use restrictions ($1,280,000) (f) Excavation, soil washing, and land use restrictions ($1,630,000) (f) Excavation, off-post treatment/disposal, and land use restrictions ($2,120,000) (f)
Stormwater Discharge Area (SWMU 45)	6×10^{-7}	0.008	NE	3×10^{-6}	0.40	4.0	Moderate risk	No	None	***Land use restrictions ($12,000)***
Old Dispensary Discharge - Building 400 (SWMU 48)	1×10^{-6}	0.05	NE	9×10^{-8}	0.04	NE	Low risk	No	None	***Land use restrictions ($12,000)***

(a) Based on the Phase II RFI Report. In accordance with UAC 315-101, a SWMU requires active corrective measures if risks, HIs, or blood lead levels under the reasonably anticipated land use scenario exceed 1×10^{-4}, 1.0, or 10 µg/dL, respectively. The maximum risk, HI, and blood level are reported.
(b) Site-Wide Ecological RA Report (SWERA; Rust E&I, 1997). The HIs for the TEAD SWMUs were compared to a reference study area (RSA) HI; the ratios of the HIs formed the primary basis for categorization of risk (Rust E&I, 1997).
(c) Human health contaminants of concern.
(d) The preferred corrective measures alternative for each SWMU is shown in bold italic type.
(e) Only land use restrictions are considered because identified COCs produce insignificant risks to human health and the environment.
(f) Also includes UXO survey and possibly clearance technologies.
(g) Pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).

1.0 INTRODUCTION

This document is the Corrective Measures Study (CMS) Report for the Group A Suspected Releases Solid Waste Management Units (SWMUs) at Tooele Army Depot (TEAD; formerly the North Area), Tooele, Utah. It has been prepared for TEAD, in association with the U.S. Army Environmental Center (USAEC), under Alternatives Development and Decision Documents for TEAD - North Area (TEAD-N), Contract No. DACA31-94-D-0060, Delivery Order No. 1. This CMS Report was developed in accordance with Module VII, Corrective Action, of the Resource Conservation and Recovery Act (RCRA) Corrective Action Permit (CAP; UT3213820894) issued to TEAD by the State of Utah Department of Environmental Quality (UDEQ) in January 1991.

1.1 PURPOSE AND SCOPE

The CMS Report represents one of the major steps in the RCRA corrective action process of protecting human health and the environment from the chemicals released at a facility. In accordance with State of Utah guidance, this report is based on the evaluations and conclusions of the Phase II RCRA Facility Investigation (RFI) Report (Montgomery Watson, 1997) and the CMS Work Plan (Dames & Moore, 2000). The RFI delineates the nature and extent of chemical constituents in the environment, and evaluates potential risks to human health and impacts to the environment. The CMS Work Plan identifies site-specific corrective measures alternatives that address the potential risks and hazards at each SWMU.

The purpose of this CMS Report is to analyze the corrective measures alternatives developed in the CMS Work Plan (Dames & Moore, 2000) for the nine Group A SWMUs determined in the Phase II RFI Report (Montgomery Watson, 1997) to pose unacceptable risks to human health risk under the hypothetical future residential land use scenario, which must be evaluated per Utah Administrative Code (UAC) R315-101-5.2(b)(1). The objective in conducting the CMS is to protect human health and the environment during current and expected future land use (i.e., military land use, based on the TEAD Conversion and Reuse Plan (Tooele County Economic Development Corporation, 1995)). This does ***not*** include cleaning up the facility to standards that apply for other land uses, such as agriculture or residential development. If these uses are considered in the future, it will be necessary to reevaluate the corrective measures alternatives identified for the Group A SWMUs.

The CMS Report is intended to be used in conjunction with the CMS Work Plan **(Dames & Moore, 2000);** ***most information presented in the work plan is not repeated in this report***. The CMS Work Plan summarizes TEAD background information, including location, physical characteristics, history, present mission, future use, and previous investigations/regulatory overview. Also included for each SWMU are descriptions of background, summaries of contamination assessment from the Phase II RFI Report (Montgomery Watson, 1997), results of human health and ecological risk assessments (RAs), interim corrective actions (as applicable), identification of corrective action objectives (CAOs) and contaminants of concern (COCs), qualitative estimates of extent of contamination (as applicable), and development of corrective measures alternatives.

1.2 BACKGROUND

TEAD is located in Tooele Valley in Tooele County, Utah, immediately west of the City of Tooele and approximately 30 miles southwest of Salt Lake City (Figure 1-1). The U.S. Army Ordnance Department established the facility in 1942, and it was named the Tooele Ordnance Depot. It was redesignated as TEAD-N in August 1962; also at this time, the former Deseret Chemical Warfare Depot was renamed TEAD - South Area (TEAD-S). Both the North and South Areas of TEAD have been major ammunition storage and equipment maintenance installations that support other U.S. Army installations throughout the western United States. In 1996, TEAD-N and TEAD-S were designated as TEAD and Tooele Chemical Activity (TECA), respectively. In October 1996, TECA was renamed the Deseret Chemical Depot (DCD).

The current missions of TEAD are:

- To receive, store, issue, maintain, and dispose of munitions
- To provide installation support to attached organizations
- To operate other facilities as assigned.

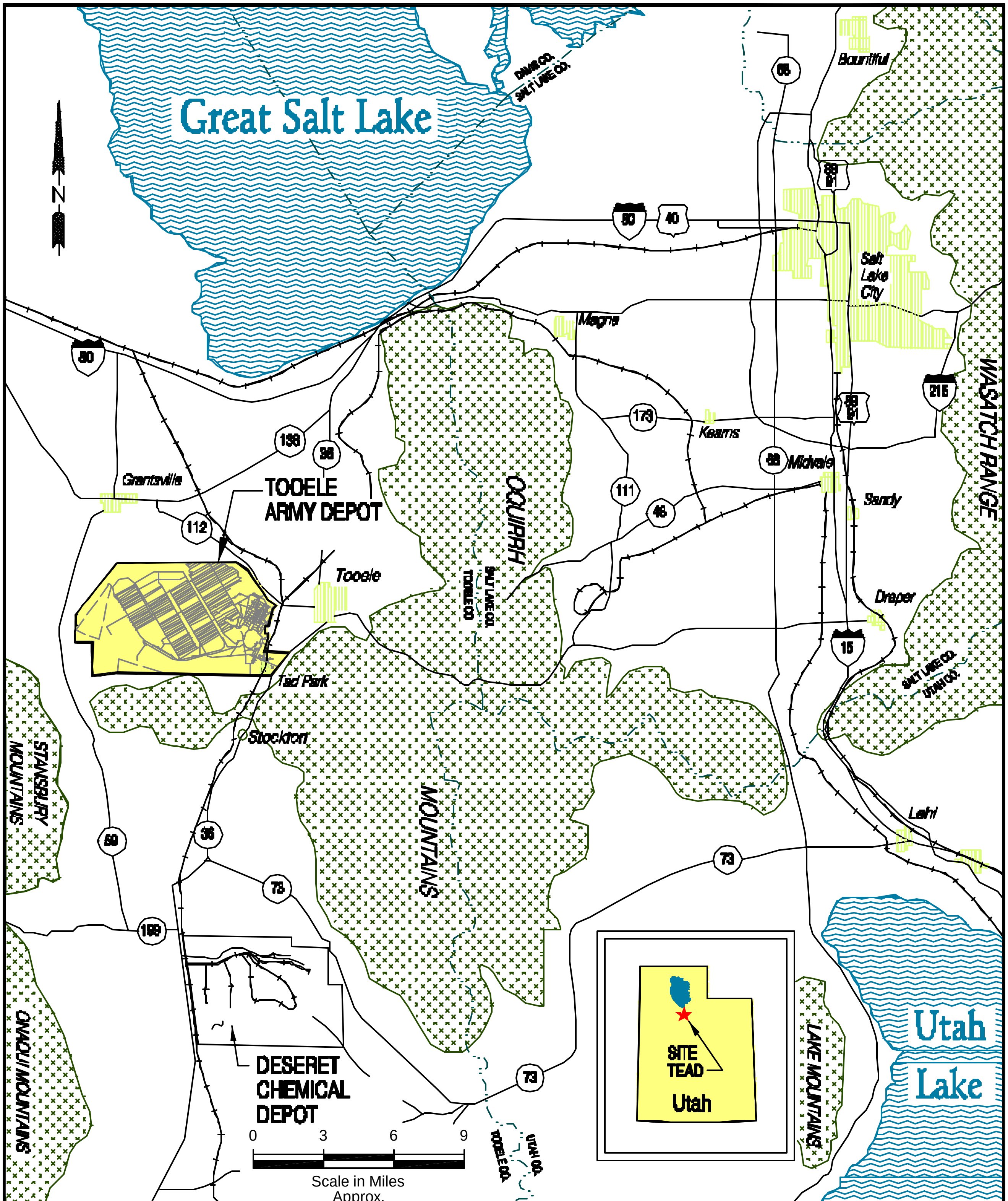
The mission of maintaining and repairing equipment was discontinued in 1995.

Developed features at TEAD include igloos, magazines, administrative buildings, an industrial maintenance area, military and civilian housing, roads, and vehicle storage hardstands and other allied infrastructure. In 1993, TEAD was placed on the list of military facilities scheduled for realignment under the Base Realignment and Closure (BRAC) Program.

As a result of past activities at the installation, TEAD was included in the U.S. Army's Installation Restoration Program (IRP) in 1978. The first component of that program was an Installation Assessment (U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), 1979), which identified a number of known and potential waste and spill sites and recommended further investigations.

In 1984, TEAD was nominated for inclusion on the National Priority List (NPL) because of identified hazardous constituents at some sites, particularly the Industrial Waste Lagoon (IWL; SWMU 2). However, TEAD was not placed on the NPL until October 1990. In the interim, the U.S. District Court for the State of Utah issued a consent decree to TEAD for groundwater contamination at SWMU 2.

As part of being placed on the NPL, a Federal Facility Agreement (FFA) was entered into between the U.S. Army, U.S. Environmental Protection Agency (EPA) Region



SOURCE: RUST E&I, 1995

FIGURE 1-1
LOCATION MAP OF
TOOELE ARMY DEPOT
AND VICINITY

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8, and UDEQ in September 1991. The FFA addresses 17 SWMUs under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

In January 1991, TEAD was issued a RCRA Post Closure Permit for the IWL (SWMU 2). The permit included a CAP that required action at 29 SWMUs. Additional SWMUs have since been added to the RCRA CAP, which is regulated by UDEQ.

Since the initial assessment of TEAD, a number of environmental investigations have been performed (and are ongoing) under CERCLA or RCRA. At TEAD, these additional investigations have identified 57 sites, including eight designated as the Group A Suspected Releases SWMUs. These sites are managed under the RCRA CAP program. The Phase II RFI Report (Montgomery Watson, 1997) determined that nine Group A SWMU areas pose a human health risk above 1×10^{-6} for carcinogens or a hazard index (HI) greater than 1.0 for noncarcinogens under the hypothetical future residential land use scenario. Therefore, according to UAC R315-101-6(c)3, a risk-based closure will not be granted, and a site management plan – the requirements of which are met by a CMS – must be prepared.

Two Group A SWMU areas – Main Demolition Area (SWMU 1) and Propellant Burn Pans (SWMU 1d) – are not addressed in this report. They currently operate with interim status under a RCRA Part B permit application. Further environmental sampling at these sites was deferred by U.S. Army and regulatory personnel pending future RCRA closure activities.

This CMS Report discusses the following Group A SWMUs:

- Burn Pad (SWMU 1b)
- Trash Burn Pits (SWMU 1c)
- Ammunition Engineering Directorate (AED) Deactivation Furnace Site (SWMU 20)
- Deactivation Furnace Building (SWMU 21)
- Pesticide Handling and Storage Area (SWMU 34)
- Contaminated Waste Processing Plant (SWMU 37)
- Bomb Washout Building (SWMU 42)
- Stormwater Discharge Area (SWMU 45)
- Old Dispensary Discharge - Building 400 (SWMU 48).

Figure 1-2 shows the location of the Group A SWMUs evaluated in this CMS Report.

1.3 REPORT ORGANIZATION

The remainder of the CMS Report is organized as follows:

- Description of evaluation criteria used in the detailed analysis of corrective measures alternatives (Section 2.0).

- Summary of pertinent information presented in the Phase II RFI (Montgomery Watson, 1997) and the CMS Work Plan (Dames & Moore, 2000) for SWMUs 1b, 1c, 20, 21, 34, 37, 42, 45, and 48, respectively (Sections 3.0 through 11.0). This includes a description of the SWMU; the magnitude and extent of contamination; results of the human health risks and hazards assessment for realistic future uses only; results of the ecological RA; CAOs; COCs; and potentially applicable corrective measures alternatives. Each area-specific corrective measures alternative is evaluated in detail based on the evaluation criteria presented in Section 2.0. In addition, corrective measures alternatives for each of the SWMUs are compared, and the preferred alternative is identified.

- Summary of recommended corrective measures alternatives for the Group A SWMUs (Section 12.0).

- References (Section 13.0).

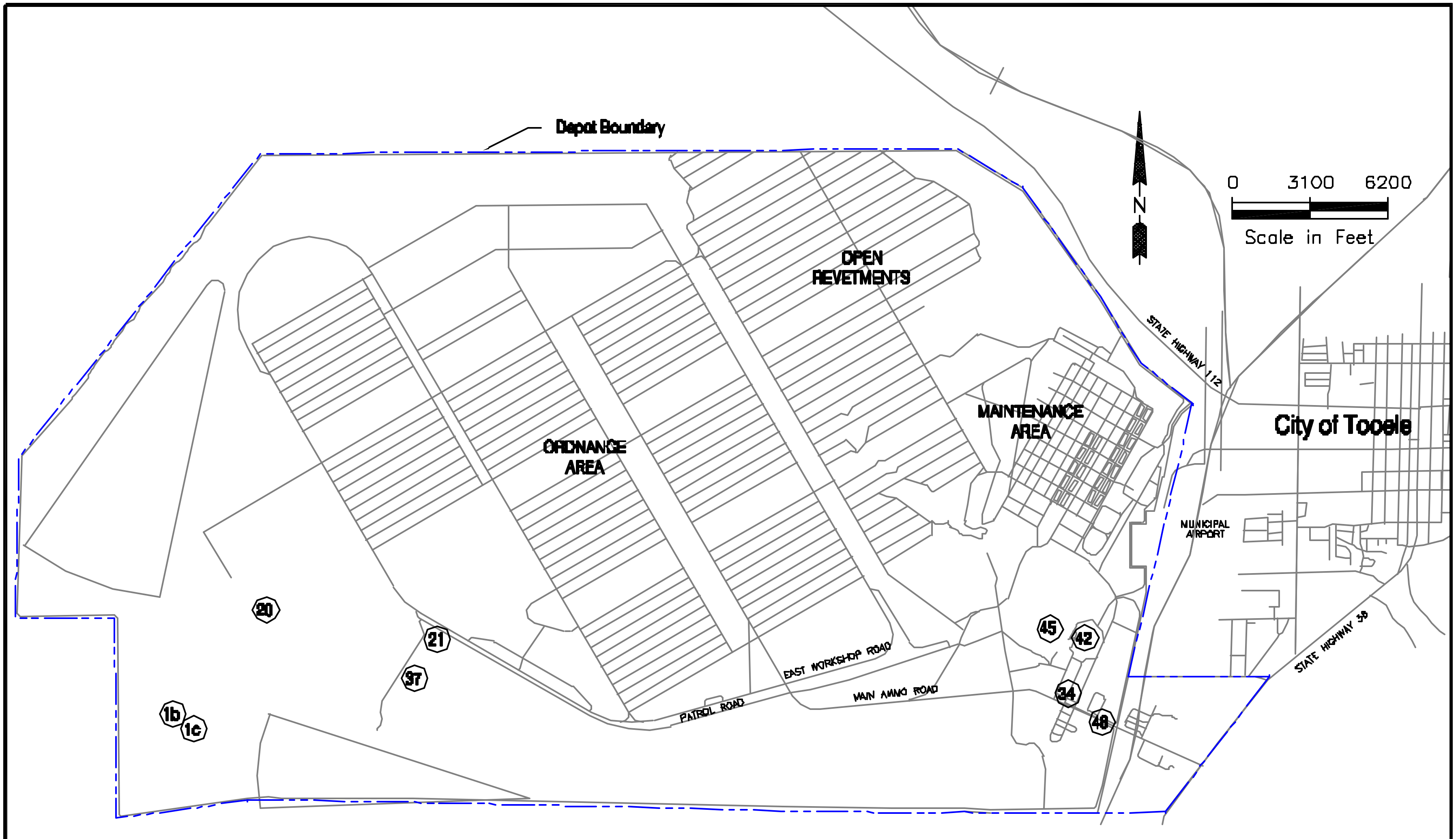
- Estimated costs for each recommended corrective measures alternative (Appendix A).

- Methodology and results of post-corrective measures ecological assessments for SWMUs 21 and 42 (Appendix B).

- Estimated costs for corrective measures assuming unrestricted land use (Appendix C).

- Additional data collection activities for SWMUs 20 and 21 (Appendix D).

- Summary of explosive risks for SWMUs 1b, 1c, and 42 and geophysical survey results for SWMU 42 as presented in the RFI (Appendix E).



LEGEND

- 1b BURN PAD
- 1c TRASH BURN PITS
- 20 AED DEACTIVATION FURNACE SITE
- 21 DEACTIVATION FURNACE BUILDING
- 34 PESTICIDE HANDLING AND STORAGE AREA
- 37 CONTAMINATED WASTE PROCESSING PLANT
- 42 BOMB WASHOUT BUILDING
- 45 STORMWATER DISCHARGE AREA
- 48 OLD DISPENSARY DISCHARGE—BUILDING 400

SOURCE: RMS CORPORATION OCTOBER, 1988

FIGURE 1-2
LOCATION OF GROUP A
SUSPECTED RELEASES SWMUs
TOOELE ARMY DEPOT

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2.0 DESCRIPTION OF EVALUATION CRITERIA

The CMS Work Plan (Dames & Moore, 2000) identifies corrective measures alternatives for the Group A SWMUs being addressed in the CMS process. This is accomplished by developing CAOs for the contaminants of potential concern (COPCs) in the various media under the assumed future land use scenarios.

The CAOs include quantitative risk-based objectives and qualitative regulatory-driven objectives. They are based on land use and potential receptor assumptions, exposure pathways, results of the human health RA, regulatory criteria, and background sample results. The CAOs for each of the Group A SWMUs are based on current and likely future military use scenarios. The CAOs were developed in accordance with UAC R315-101, including the “Principle of Non-Degradation”; EPA guidance (USEPA, 1991); the human health RA for the Group A SWMUs (Montgomery Watson, 1997); the Sitewide Ecological Risk Assessment (SWERA; Rust E&I, 1997); and U.S. Army policy (Radkiewicz, 1995). The COPCs are then compared to quantitative CAOs to identify COCs.

To determine which contaminants require action, consideration is given to whether average concentrations across the site (i.e., exposure point concentration (EPC) as used in the RA) exceed the CAO and whether COCs are isolated and at low levels.

Corrective measures may include management measures or treatment technologies that meet the CAOs and address the COCs; these measures are assembled into corrective measures alternatives. The alternatives are developed according to RCRA guidance on performing a CMS (Sperber, 1996) and UDEQ regulations. The CMS Work Plan explains the methodology in detail. Figure 2-1 summarizes the alternatives development procedure.

RCRA criteria are used to evaluate each of the corrective measures alternatives identified in the CMS Work Plan. In accordance with RCRA guidance on performing a CMS (Sperber, 1996) and Module VII of the RCRA Part B Permit for TEAD, the detailed evaluation of each corrective measures alternative presented in Sections 3.0 to 11.0 considers technical criteria (including performance, reliability, implementability, and safety), protection of human health, protection of the environment, administrative feasibility, and cost, as defined below:

- Technical criteria
  - Performance – Evaluates whether the corrective measures alternative can perform its intended function and meet the CAOs developed in the CMS Work Plan (Dames & Moore, 2000), including compliance with Federal, State, and local regulations. This criterion considers site and waste characteristics, and also the length of time the alternative maintains its intended level of effectiveness.

- Reliability – Describes the long-term effectiveness and permanence of each alternative. This criterion evaluates the adequacy of the corrective measure based on performance at similar sites, operation and maintenance (O&M) requirements, long-term environmental monitoring needs, and residuals management requirements.

- Implementability – Assesses the technical and institutional feasibility of executing a corrective measures alternative, including constructability, permit and legal/regulatory requirements, availability of materials, and length of time from implementation to realization of beneficial effects.

- Safety – Considers the potential threats to workers, nearby communities, and the environment during implementation of the corrective measure.

• Human health assessment – Evaluates the extent to which each alternative protects human health. This criterion considers the classes and concentrations of contaminants left onsite, potential exposure routes, and potentially affected populations. Residual contaminant concentrations are also compared to existing criteria, standards, or guidelines.

• Environmental assessment – Evaluates short- and long-term effects of the corrective measure on the environment, including adverse impacts to environmentally sensitive areas.

• Administrative feasibility – Considers compliance with applicable Federal, State, and local environmental and public health standards, requirements, criteria, or limitations.

• Cost – Presents capital and annual O&M costs for each corrective measures alternative. Capital costs include direct and indirect costs. Annual O&M costs typically include labor, maintenance, energy, and sampling/analysis. For purposes of comparison, costs are presented in terms of present worth (i.e., the current value of a future expenditure). The cost estimates are based on conventional cost estimating guides, vendor information, and engineering judgment. Appendix A presents the detailed cost estimate tables.

The CMS Report addresses how the alternatives reduce exposure to contamination, contaminant concentration, or contaminant migration.

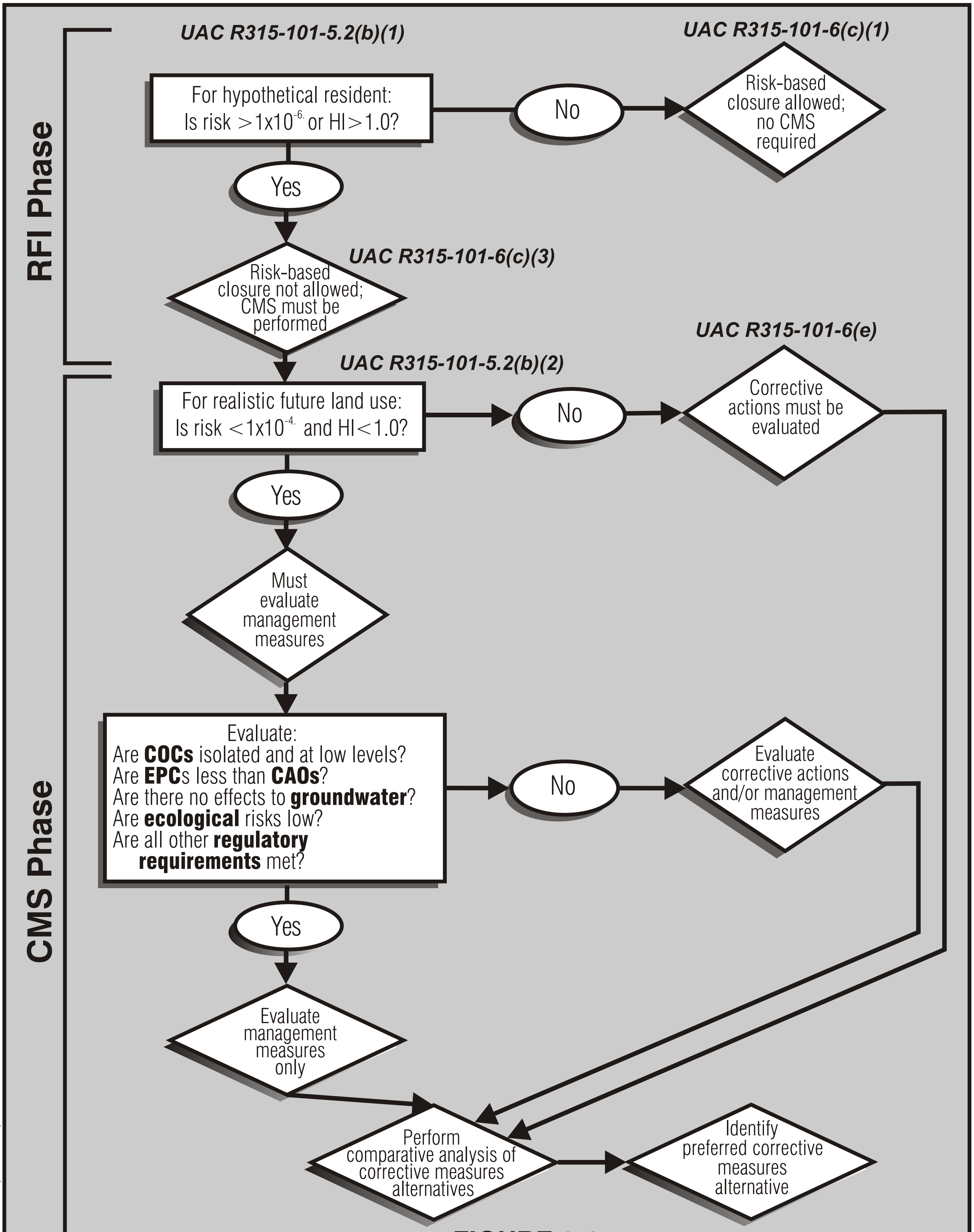


FIGURE 2-1
DEVELOPMENT OF CORRECTIVE MEASURES ALTERNATIVES

09604\056 FIG2-1.CDR (05-31-00) KD

3.0 BURN PAD (SWMU 1b)

Section 3.0 evaluates corrective measures alternatives for the Burn Pad (SWMU 1b; Figure 3-1). Data from the CMS Work Plan (Dames & Moore, 2000), the human health RA (Montgomery Watson, 1997), and the SWERA (Rust E&I, 1997) are also summarized below.

3.1 SUMMARY OF RAs AND CMS WORK PLAN

As shown on Figure 3-1, the Burn Pad (SWMU 1b) is located in a small erosional valley approximately 2,000 feet east of the Main Demolition Area (SWMU 1). This site consisted of a 300- by 100-foot cleared pad where propellant was burned in open trenches and projectiles were flashed. Based on historical aerial photographs from 1959, 1966, and 1978, five separate trenches were located in the pad (Montgomery Watson, 1997). Site activities began prior to 1959 and were reportedly discontinued before 1977 (U.S. Army Environmental Hygiene Agency (AEHA), 1983). The area has since been regraded and revegetated and is no longer used for demilitarization activities. No permanent structures were associated with operations at the Burn Pad (AEHA, 1983).

The Phase II RFI (Montgomery Watson, 1997) identified unacceptable risks and hazards to human health at SWMU 1b under the hypothetical future residential land use scenario. Therefore, according to EPA guidance and UAC R315-101-6(c)(3), this SWMU is included in the CMS process, and corrective measures must be evaluated. However, the human health RA concluded that SWMU 1b presents no unacceptable risk to current Depot workers or future construction workers. In addition, because the assumed future land use is continued military use, there is no unacceptable risk under the realistic future land use scenario. Although the hypothetical future residential land use scenario presents unacceptable risks, the realistic future land use scenario presents no unacceptable risks; therefore, management measures are evaluated according to UAC R315-101-1 (b)(4).

During field investigations, the unexploded ordnance (UXO) subcontractor found 6 ounces of explosives in 1- to 2-ounce pieces and a projectile fuse. Because UXO was encountered during the field investigations, this SWMU is subject to the Munitions Rule. Appendix E presents the summary of explosive risk as presented in the Phase II RFI.

No groundwater monitoring was conducted at SWMU 1b. However, according to the Phase II RFI (Montgomery Watson, 1997), the site constituents are not expected to affect groundwater based on the relatively low levels of contamination detected in the soil, low precipitation rates, high evaporation rates, and depth to groundwater (which is estimated to be over 700 feet below ground surface (bgs)).

The SWERA (Rust E&I, 1997) indicated that SWMU 1b poses a low ecological risk and recommended no corrective measures to reduce risk.

The CMS Work Plan (Dames & Moore, 2000) identified no COCs for either surface or subsurface soil at SWMU 1b.

The CAOs for SWMU 1b are:

- To ensure that – if the current military land use scenario changes in the future to residential or other use – appropriate measures are taken to adequately protect human health and the environment.

- To comply with UAC R315-101 and all its parts.

Based on the evaluation of risks and hazards to human health and the environment, and regulatory requirements, only management measures are evaluated for the Burn Pad. The CMS Work Plan (Dames & Moore, 2000) identified the following corrective measures alternative for SWMU 1b:

SWMU 1b	Corrective Measures Alternative
BURN PAD	**Land use restrictions** Impose land use restrictions to prevent residential development

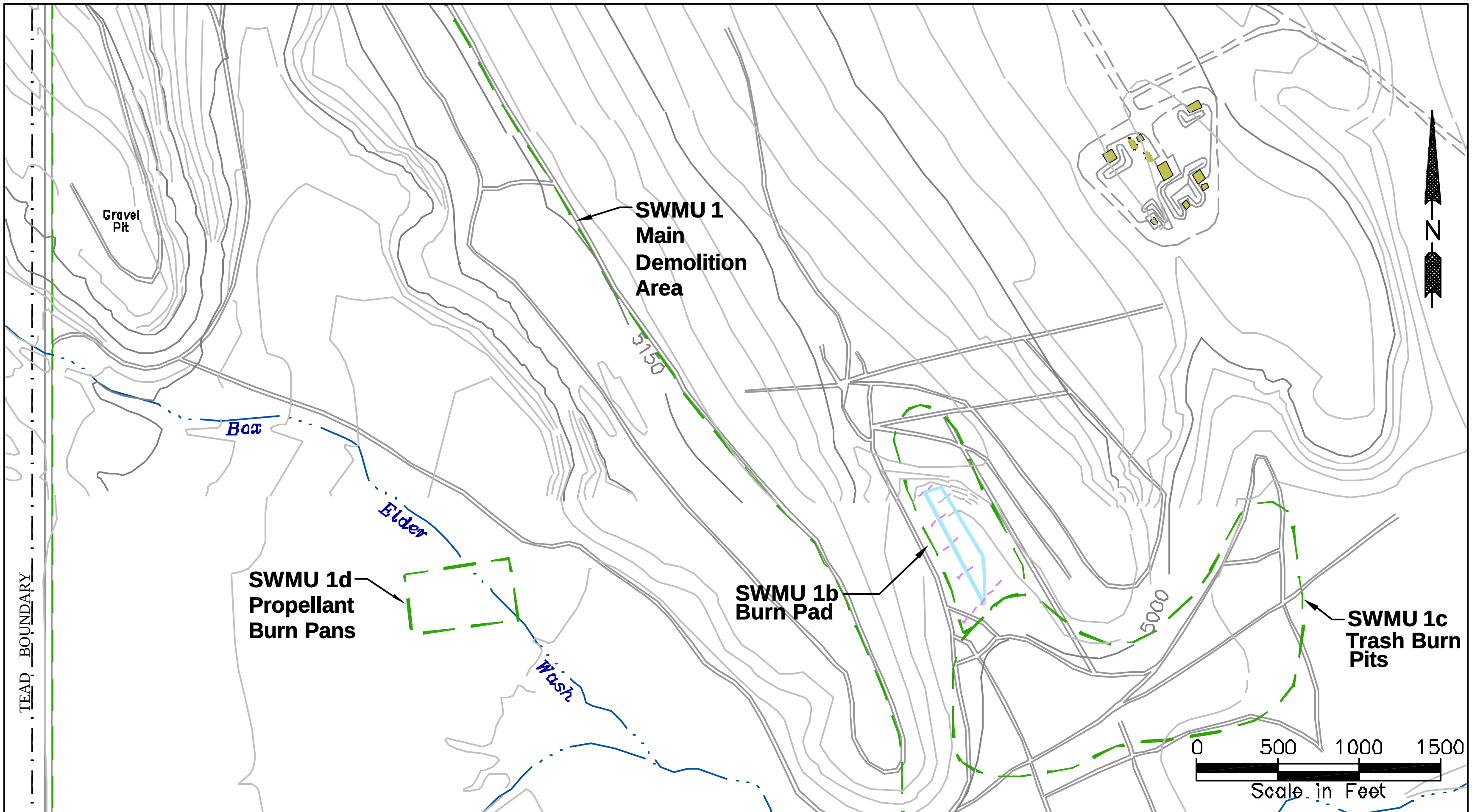
Table 3-1 summarizes the risks to human health and the environment evaluated in the Phase II RFI (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997), and the corrective measures alternatives identified for SWMU 1b in the CMS Work Plan (Dames & Moore, 2000).

3.2 DETAILED EVALUATION OF CORRECTIVE MEASURES ALTERNATIVE

Alternative 1 is the application of land use restrictions to prevent future residential use of the site. These restrictions would be incorporated into TEAD's master land use plan. This plan also calls for inspections and monitoring to ensure the restrictions are being observed. Because U.S. Army regulations direct that all revisions to this plan be evaluated with regard to potential impacts to human health and the environment, authorization for another (i.e., nonmilitary) use of SWMU 1b would require the resolution of conflicts between identified risks and hazards and proposed changes in land use at the site. The land use restrictions will include a notation that prohibits Depot Worker activities from occurring at the site unless ordnance personnel have performed a UXO survey/clearance for the intended area of use. The SWMU will have signage posted to warn of UXO potential and stating the access restrictions. In addition, the entire TEAD facility is secured by fences and patrolled by guards.

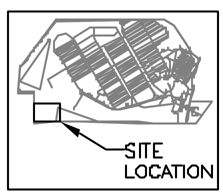
The real property planning board has authority over land use at the base, and is responsible for developing, enforcing, and modifying the installation's master land use plan. The authority of the board is derived from the responsible major Army command (i.e., Operations Support Command (OSC)), which has specific oversight functions.

09604\056 File: FIG3-1.DWG Date/Time: May 26, 2000 8:54 a.m. Scale: 1=0 kdembin Xrefs:



LEGEND

ACCESS ROADWAY
5150 ELEVATION CONTOUR
OPEN TRENCHES VISIBLE IN AERIAL PHOTOGRAPHS
PAD
SWMU BOUNDARY (APPROX.)



Source: Modified from USGS Grantsville and South Mountain 7.5 minute quadrangles. Montgomery Watson, 1995 Features from EPIC aerial photographs 1959–1978.

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FIGURE 3-1
BURN PAD (SWMU 1b)
TOOELE ARMY DEPOT

TABLE 3-1

Summary of Phase II RFI, SWERA, and CMS Work Plan
Burn Pad (SWMU 1b)

<table>
<tr><th colspan="10">Phase II RFI (Montgomery Watson, 1997)</th><th>SWERA (Rust E&I, 1997)</th><th colspan="2">CMS Work Plan (Dames & Moore, 2000)</th></tr>
<tr><th colspan="9">Human Health Risk Assessment (a)</th><th>Impacts to Groundwater</th><th>Ecological Risk</th><th>COCs</th><th>Corrective Measures Alternative (b)</th></tr>
<tr><th colspan="4">Hypothetical Future Residential Land Use Scenario (c)</th><th colspan="5">Realistic Future Land Use Scenario (d)</th><td rowspan="4">None</td><td rowspan="4">Low</td><td rowspan="4">None</td><td rowspan="4">Land use restrictions</td></tr>
<tr><th></th><th>Risk</th><th>HI</th><th>Blood Lead Level (e)</th><th></th><th>Risk</th><th>HI</th><th>Blood Lead Level (e)</th><th></th></tr>
<tr><td>Adult</td><td>$2{\times}10^{-4}$</td><td>NE (f)</td><td>NE</td><td>Military</td><td>$2{\times}10^{-7}$</td><td>$4{\times}10^{-4}$</td><td>3.4</td><td></td></tr>
<tr><td>Child</td><td>NE</td><td>70</td><td>6.3</td><td>Construction</td><td>$2{\times}10^{-7}$</td><td>0.04</td><td>3.5</td><td></td></tr>
</table>

(a) Risks, HIs, and blood lead levels that are above comparison levels appear in bold type.
(b) The selected corrective measures alternative appears in bold italic type.
(c) EPA guidance and UAC R315-101-5.2(b)(1) require evaluation of the hypothetical future land use scenario. Because risks and HIs are greater than $1{\times}10^{-6}$ and 1.0, respectively, EPA guidance and UAC R315-101-6(c)(3) indicate that a CMS must be performed.
(d) EPA guidance and UAC R315-101-5.2(b)(2) require evaluation of the realistic future land use scenario. Because risks and HIs are less than $1{\times}10^{-4}$ and 1.0, respectively, UAC R315-101-6(d) indicates that management measures can be evaluated.
(e) Blood lead levels are expressed as micrograms per deciliter (µg/dL) for 95 percent of the population (should not exceed 10 µg/dL).
(f) NE = pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).

These responsibilities include approving the installation's master land use plan and any proposed changes. Appendix C of the CMS Work Plan (Dames & Moore, 2000) presents a more detailed description of land use restrictions.

Alternative 1 – land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – Land use restrictions limit future exposure by preventing future residential development of the site and also meet the CAOs developed in the CMS Work Plan (Dames & Moore, 2000). This corrective measures alternative is applicable to site characteristics and meets the identified CAOs with no decrease in effectiveness over time.

  – Reliability – Land use restrictions are effective over the long term and have been implemented at many sites with positive results. No additional exposure should occur while the restrictions are in place. No O&M, management of waste materials, or long-term environmental monitoring is required.

  – Implementability – Because SWMU 1b is currently under military use, continuing restrictions at this site should not be difficult. This corrective measures alternative immediately meets the CAOs developed in the CMS Work Plan (Dames & Moore, 2000).

  – Safety – No intrusive activities are required for implementation of this alternative.

- Human health assessment – Restricting future development of the site protects human health by preventing residential exposure to the previously identified contaminants in soil at SWMU 1b. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs, but above residential use CAOs.

- Environmental assessment – The SWERA (Rust E&I, 1997) identified no adverse effects to ecological receptors as a result of the contaminants in soil at SWMU 1b.

- Administrative feasibility – The implementation of land use restrictions at this site meets the specified requirements of UAC R315-101. No violations of environmental or public health standards were identified at SWMU 1b. Because SWMU 1b is to remain under U.S. Army control, land use restrictions are administered through the installation's real property planning board; therefore, this alternative is considered to be administratively feasible.

- Cost – The estimated cost of implementing this corrective measures alternative is $12,000. Table A-1 (see Appendix A) presents the detailed cost estimate.

3.3 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVE

Based on the above evaluation, Alternative 1 – land use restrictions – is identified as the preferred alternative for SWMU 1b because:

- It meets the requirements of UAC R315-101.
- It has been demonstrated at other sites.
- It is reliable and implementable.

4.0 TRASH BURN PITS (SWMU 1c)

Section 4.0 evaluates corrective measures alternatives for the Trash Burn Pits (SWMU 1c; Figure 4-1). Data from the CMS Work Plan (Dames & Moore, 2000), the human health RA (Montgomery Watson, 1997), and the SWERA (Rust E&I, 1997) are also summarized below.

4.1 SUMMARY OF RAs AND CMS WORK PLAN

As shown on Figure 4-1, the Trash Burn Pits (SWMU 1c) are located in the southwest corner of TEAD, in a small erosional valley 2,000 feet east of the Main Demolition Area (SWMU 1) and adjacent to the Burn Pad (SWMU 1b). The site is an open, graded, and vegetated area of approximately 45 acres, with no permanent structures. Disposal and waste-burning activities occurred at SWMU 1c from approximately 1959 to the 1980s. The disposal pits were reportedly several hundred feet long, 8 to 10 feet wide, and 4 to 6 feet deep. Containers and other wastes dating from the 1950s and 1960s were identified within test pits excavated in areas of waste disposal activities. Burn areas on the ground surface were encountered in test pits in areas of more recent waste disposal, dating from the 1970s and 1980s. The presence of a dark area and berm were spotted on historical photographs at the locations shown on Figure 4-1.

The Phase II RFI (Montgomery Watson, 1997) identified unacceptable risks and hazards to human health at SWMU 1c under the hypothetical future residential land use scenario. Therefore, according to EPA guidance and UAC R315-101-6(c)(3), this SWMU is included in the CMS process, and corrective measures must be evaluated. However, the human health RA concluded that SWMU 1c presents no unacceptable risk to current Depot workers. In addition, because the assumed future land use is continued military use, there is no unacceptable risk under the realistic future land use scenario. Under the future construction worker scenario, the noncancer HI was estimated to be 3.0, which exceeds the State of Utah goal of 1.0. However, the Phase II RFI indicated that this HI is due to the presence of naturally occurring manganese in soil at the site. According to the human health RA (Montgomery Watson, 1997), the human health risks due to other COCs are within their respective State of Utah target levels. Although the hypothetical future residential land use scenario presents unacceptable risks, the realistic future land use scenario presents no unacceptable risks; therefore, management measures are evaluated according to UAC R315-101-1(b)(4).

During the 1992 field investigation, the UXO subcontractor found the following ordnance types and uncased explosives in or near the Trash Burn Pits – 75-millimeter (mm) projectile, 81-mm mortar, 90-mm projectile, 105-mm projectile, bomb loading unit 4, bomb loading unit 4 fuze, 3.5-inch rocket fuze, 5.0-inch rocket fuze, projectile fuze with booster, M557 point detonating fuze, nonelectric blasting cap, antitank mine, antitank mine fuze, and M125 flare. Because UXO and uncased explosives were encountered at SWMU 1c, this SWMU is subject to the Munitions Rule. Appendix E presents the summary of explosive risk as presented in the Phase II RFI.

No groundwater monitoring was conducted at SWMU 1c. However, according to the Phase II RFI (Montgomery Watson, 1997), the site constituents are not expected to affect groundwater based on the relatively low levels of contamination detected in the deeper soil borings, low precipitation rates, high evaporation rates, and depth to groundwater (which is estimated to be over 700 feet bgs).

The SWERA (Rust E&I, 1997) indicated that SWMU 1c poses a low ecological risk and recommended no corrective measures to reduce risk.

In the CMS Work Plan (Dames & Moore, 2000), cyclotrimethylenetrinitramine (RDX) was determined to be a COC for surface soil, and beryllium and lead were determined to be COCs for subsurface soil. The COC exceedances occurred at two locations for RDX and at only one location each for beryllium and lead. The COCs identified at the site were evaluated in conjunction with results of the human health RA to determine whether active corrective measures need to be considered. As stated in the Phase II RFI (Montgomery Watson, 1997), the human health RA used the exposure point concentration (EPC) to calculate human health risk. (The EPC is statistically derived and represents the likely concentration that an individual would be exposed to from working in the area of the SWMU.) The EPC for each COC was compared to the respective CAO.

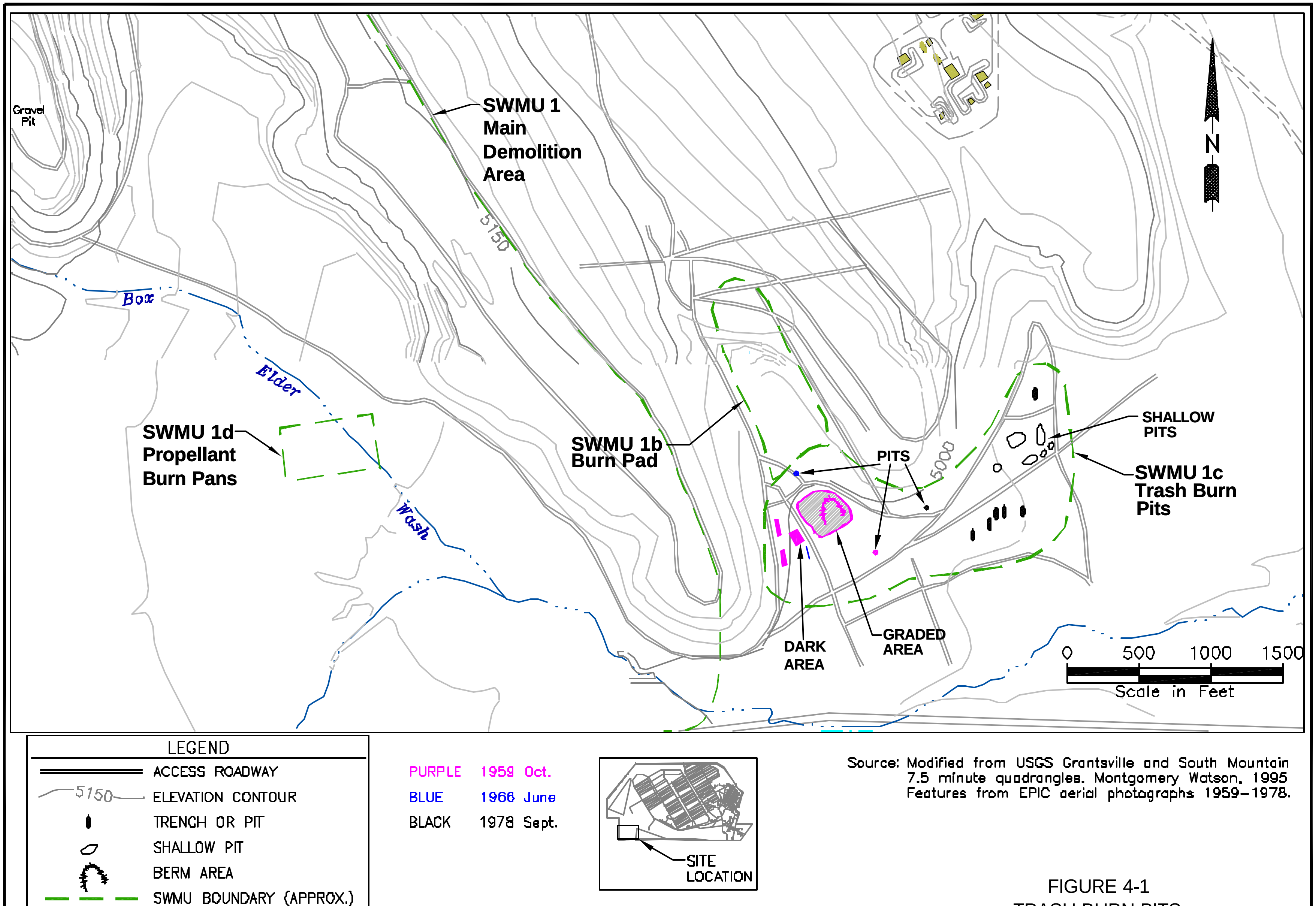
For each of the three COCs identified at SWMU 1c – RDX, beryllium, and lead – the sitewide EPCs were determined to be well below their corresponding CAOs. Therefore, though COCs are present in isolated soil samples at SWMU 1c, they do not result in unacceptable risks to human health across the site. Thus, no active corrective measure was recommended for any of the contaminants detected at the site (Dames & Moore, 2000).

The CAOs for SWMU 1c are:

- To ensure that – if the current military land use scenario changes in the future to residential or other use – appropriate measures are taken to adequately protect human health and the environment.

- To comply with UAC R315-101 and all its parts.

Based on the evaluation of risks and hazards to human health and the environment, COC and EPC evaluations, and regulatory requirements, only management measures are evaluated for the Trash Burn Pits. The CMS Work Plan (Dames & Moore, 2000) identified the following corrective measures alternative for SWMU 1c:



Source: Modified from USGS Grantsville and South Mountain 7.5 minute quadrangles. Montgomery Watson, 1995 Features from EPIC aerial photographs 1959–1978.

FIGURE 4-1
TRASH BURN PITS
(SWMU 1c)
TOOELE ARMY DEPOT

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SWMU 1c	Corrective Measures Alternative
TRASH BURN PITS	**Land use restrictions** Impose deed restrictions to prevent residential development

Table 4-1 summarizes the risks to human health and the environment evaluated in the Phase II RFI (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997), and the corrective measures alternatives identified for SWMU 1c in the CMS Work Plan (Dames & Moore, 2000).

4.2 DETAILED EVALUATION OF CORRECTIVE MEASURES ALTERNATIVE

Alternative 1 is the application of land use restrictions to prevent future residential use of the site. These restrictions would be incorporated into TEAD's master land use plan. This plan also calls for inspections and monitoring to ensure the restrictions are being observed. Because U.S. Army regulations direct that all revisions to this plan be evaluated with regard to potential impacts to human health and the environment, authorization for another (i.e., nonmilitary) use of SWMU 1c would require the resolution of conflicts between identified risks and hazards and proposed changes in land use at the site. The land use restrictions will include a notation that prohibit Depot worker activities from occurring at the site unless ordnance personnel have performed a UXO survey/clearance for the intended area of use. The SWMU will have signage posted to warn of UXO potential and stating the access restrictions. In addition, the entire TEAD facility is secured by fences and patrolled by guards.

The real property planning board has authority over land use at the base, and is responsible for developing, enforcing, and modifying the installation's master land use plan. The authority of the board is derived from the responsible major Army command (i.e., OSC), which has specific oversight functions. These responsibilities include approving the installation's master land use plan and any proposed changes. Appendix C of the CMS Work Plan (Dames & Moore, 2000) presents a more detailed description of land use restrictions.

Alternative 1 – land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – Land use restrictions limit future residential exposure to contaminants in soil and also meet the CAOs developed in the CMS Work Plan (Dames & Moore, 2000). This corrective measures alternative is applicable to both site and contaminant characteristics, and meets the identified CAOs with no decrease in effectiveness over time.

  – Reliability – Land use restrictions are effective over the long term and have been implemented at many sites with positive results. No

TABLE 4-1

Summary of Phase II RFI, SWERA, and CMS Work Plan
Trash Burn Pits (SWMU 1c)

Phase II RFI (Montgomery Watson, 1997)									SWERA (Rust E&I, 1997)	CMS Work Plan (Dames & Moore, 2000)	
Human Health Risk Assessment (a)								**Impacts to Groundwater**	**Ecological Risk**	**COCs (b)**	**Corrective Measures Alternative (c)**
Hypothetical Future Residential Land Use Scenario (d)				**Realistic Future Land Use Scenario (e)**				None	Low	Surface soil: RDX Subsurface soil: Beryllium Lead	***Land use restrictions***
	Risk	**HI**	**Blood Lead Level (f)**		**Risk**	**HI**	**Blood Lead Level (f)**				
Adult	**9×10^{-2}**	NE	NE (g)	Military	1×10^{-6}	0.03	3.5				
Child	NE	**1,000**	6.9	Construction	1×10^{-6}	**3 (h)**	4.2				

(a) Risks, HIs, and blood lead levels that are above comparison levels appear in bold type.
(b) For each of the three COCs identified at SWMU 1c, the sitewide exposure point concentrations (EPCs) are well below the corresponding CAOs. Therefore, though COCs are present in isolated soil samples at SWMU 1c, they do not result in unacceptable risk levels.
(c) The selected corrective measures alternative appears in bold italic type.
(d) EPA guidance and UAC R315-101-5.2(b)(1) require evaluation of the hypothetical future land use scenario. Because risks and HIs are greater than 1×10^{-6} and 1.0, respectively, EPA guidance and UAC R315-101-6(c)(3) indicate that a CMS must be performed.
(e) EPA guidance and UAC R315-101-5.2(b)(2) require evaluation of the realistic future land use scenario. Because risks and HIs are less than 1×10^{-4} and 1.0, respectively, UAC R315-101-6(d) indicates that management measures can be evaluated.
(f) Blood lead levels are expressed as micrograms per deciliter (µg/dL) for 95 percent of the population (should not exceed 10 µg/dL).
(g) NE = pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).
(h) Elevated HI due to presence of naturally occurring manganese in soil at the site.

additional exposure should occur while the restrictions are in place. No O&M, management of waste materials, or long-term environmental monitoring is required.

  - Implementability – Because SWMU 1c is currently under military use, continuing restrictions at this site should not be difficult. This corrective measures alternative immediately meets the CAOs developed in the CMS Work Plan (Dames & Moore, 2000).

  - Safety – No intrusive activities are required for implementation of this alternative.

- Human health assessment – Restricting future development of the site protects human health by preventing residential exposure to the previously identified contaminants in soil at SWMU 1c. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs, but above residential use CAOs.

- Environmental assessment – The SWERA (Rust E&I, 1997) identified no adverse effects to ecological receptors as a result of the contaminants in soil at SWMU 1c.

- Administrative feasibility – The implementation of land use restrictions at this site meets the specified requirements of UAC R315-101. No violations of environmental or public health standards were identified at SWMU 1c. Because SWMU 1c is to remain under U.S. Army control, land use restrictions are administered through the installation's real property planning board; therefore, this alternative is considered to be administratively feasible.

- Cost – The estimated cost of implementing this corrective measures alternative is $12,000. Table A-2 (see Appendix A) presents the detailed cost estimate.

4.3 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVE

Based on the above evaluation, Alternative 1 – land use restrictions – is identified as the preferred alternative for SWMU 1c because:

- It meets the requirements of UAC R315-101.
- It has been demonstrated at other sites.
- It is reliable and implementable.

5.0 AED DEACTIVATION FURNACE SITE (SWMU 20)

Section 5.0 evaluates corrective measures alternatives for the AED Deactivation Furnace Site (SWMU 20; Figure 5-1). Data from the CMS Work Plan (Dames & Moore, 2000), the human health RA (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997) are also summarized below.

5.1 SUMMARY OF RAs AND CMS WORK PLAN

Figure 5-1 shows the location and layout of the AED Deactivation Furnace Site (SWMU 20), which includes Buildings 1351, 1352, 1355, and 1356, and former Building 1354. However, only Buildings 1351 and 1352 are related to site activities. This site is located on an approximately 180- by 225-foot asphalt pad, along the road between the AED Demilitarization Facility (SWMU 19; Group B SWMUs) and the Bomb Shell Reconditioning Building (SWMU 23; Operable Unit (OU) 9). The pad is underlain by compacted gravel fill. A small area near the western corner of the pad, which was reportedly once used to store drummed residue, is referred to as the former hazardous waste holding area. Building 1351 has been active since approximately 1970; it includes a deactivation furnace (rotary-kiln type), a flashing furnace (installed in 1976), and a large air pollution control system (installed in 1976). Building 1352 is a small storage building. SWMU 20 is currently used to conduct treatability studies and operates under interim RCRA approval through an experimental variance. The areas proposed for corrective measures were contaminated prior to the facility becoming a RCRA-approved unit. Current operations do not contribute to the previous contamination.

The Phase II RFI (Montgomery Watson, 1997) identified unacceptable risks, hazards, and blood lead levels to human health at SWMU 20 under the hypothetical future residential land use scenario. Therefore, according to EPA guidance and UAC R315-101-6(c)(3), this SWMU is included in the CMS process, and corrective measures must be evaluated. However, the human health RA concluded that SWMU 20 presents no unacceptable risk to current Depot workers or future construction workers. In addition, because the assumed future land use is continued military use, there is no unacceptable risk under the realistic future land use scenario. Although the hypothetical future residential land use scenario presents unacceptable risks, the realistic future land use scenario presents no unacceptable risks; therefore, management measures are evaluated according to UAC R315-101-1(b)(4).

No groundwater monitoring was conducted at SWMU 20. However, according to the Phase II RFI (Montgomery Watson, 1997), the site constituents are not expected to affect groundwater based on the relatively low levels of contamination detected in the shallow subsurface soil, the general decrease in contaminant concentrations with depth, low precipitation rates, high evaporation rates, and depth to groundwater (which is estimated to be over 600 feet bgs).

The SWERA (Rust E&I, 1997) indicated that the contaminants detected in soil at SWMU 20 are unlikely to pose excessive or unacceptable ecological risk to TEAD receptors and recommended no corrective measures to reduce risk.

The CMS Work Plan (Dames & Moore, 2000) identified COCs by comparing the maximum concentration of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) to the respective quantitative CAO. Based on this evaluation, antimony and lead were determined to be COCs for surface soil. No COCs were identified for subsurface soil. The following table shows the maximum concentrations and EPCs of the identified COCs in surface soil compared to the CAOs:

AED Deactivation Furnace Site (SWMU 20)			
COC	**Maximum Concentration (µg/g) (a)**	**EPC (µg/g)**	**CAO (µg/g)**
Antimony	203	21	160
Lead	21,000	2,000	1,800
(a) Micrograms per gram.			

The COCs identified in surface soil were evaluated in conjunction with the results of the human health RA to determine whether active corrective measures need to be evaluated. As stated in the Phase II RFI (Montgomery Watson, 1997), the human health RA used the EPC, which represents the likely concentration that an individual would be exposed to by working in the area of the SWMU, to calculate human health risks. The EPC for each COC was compared to the respective CAO, as shown above.

Based on this comparison, which is described in detail in the CMS Work Plan (Dames & Moore, 2000), the human health risks associated with antimony under the realistic future land use scenario were considered to be acceptable. Antimony was detected in only one sample at a level slightly exceeding its CAO, and its EPC is below its CAO. The EPC for lead is slightly higher than its corresponding CAO. As discussed in the CMS Work Plan, the CAO for lead (1,800 µg/g) corresponds to a 95^{th} percentile blood lead level of 10 micrograms per deciliter (µg/dL) for a Depot worker, which is the Centers for Disease Control and Prevention (CDC) target level. Thus, the EPC of 2,000 µg/g for lead results in a blood level above this target. The human health RA performed in the Phase II RFI (Montgomery Watson, 1997) did not predict blood lead levels above the CDC target for the Depot worker. The apparent inconsistency between the results of the human health RA and the EPC versus CAO comparison blood lead level assessment is due to the use of two different blood lead level models. The model used for the CAO calculations integrates the RFI RAs performed for different groups of SWMUs at TEAD, and incorporates updated and more realistic assumptions. In addition, the four lead COC exceedances were concentrated in areas adjacent to the northwestern and northeastern edges of the asphalt pad, and the concentration of lead exceeded its CAO by more than one order of magnitude at one of these locations. Based on this evaluation, the CMS

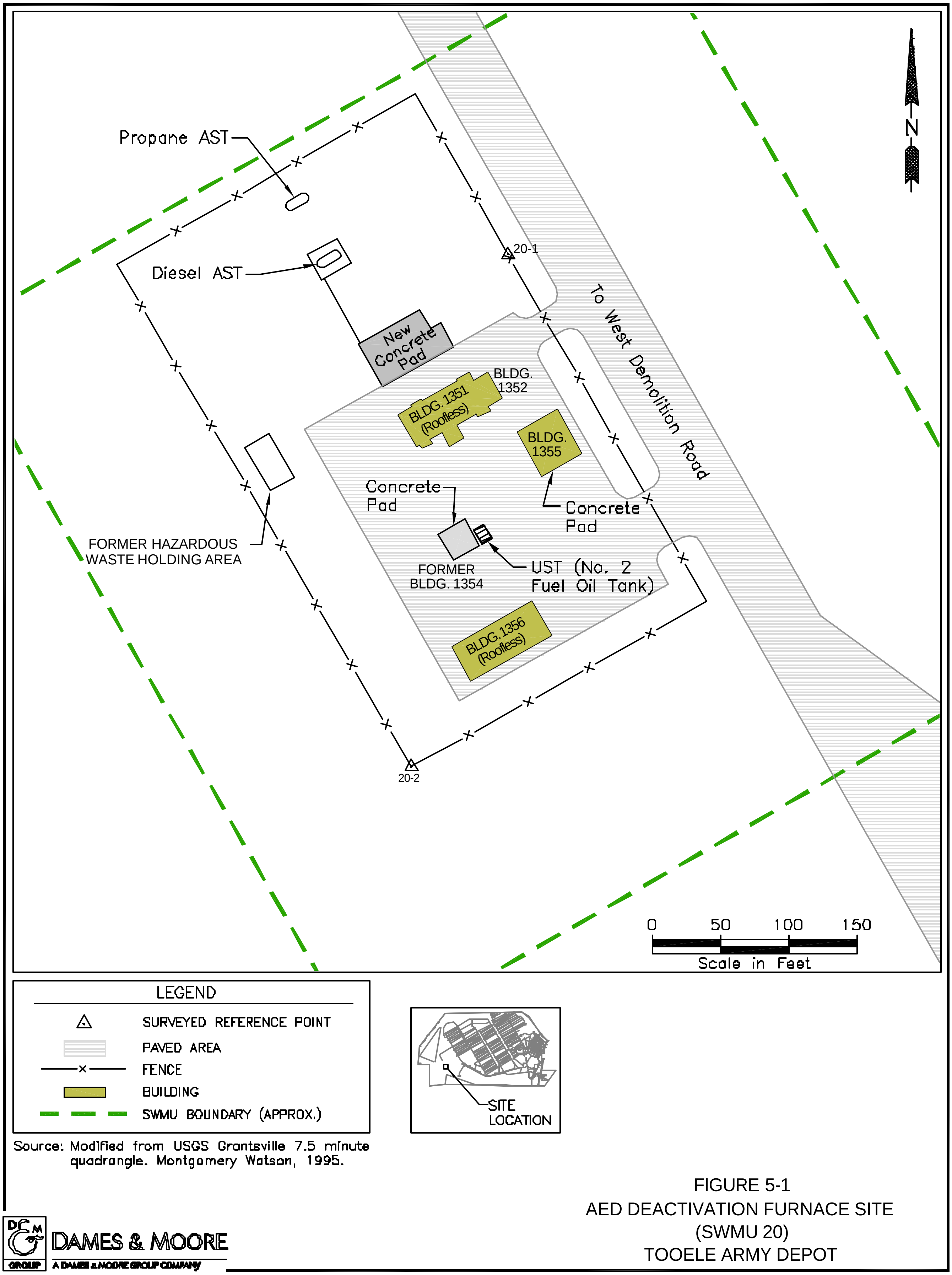

FIGURE 5-1
AED DEACTIVATION FURNACE SITE
(SWMU 20)
TOOELE ARMY DEPOT

Work Plan identified active corrective measures (i.e., treatment technologies) as well as management measures to address lead in surface soil.

Earthmoving activities were conducted in the vicinity of the new concrete pad just north of Building 1351 after the collection of Phase II data. Additional soil samples were collected and analyzed for antimony and lead to define the current extent of contamination. Appendix D discusses the additional data collection activities that occurred at SWMU 20 in December 1999 in the field north of the excavated area. No new COC locations were detected for antimony and lead; see additional data soil sampling locations on Figure 5-2. However, antimony and lead were detected above background levels adjacent to the north side of the asphalt pad. Based on the extensive RFI and additional sampling data (105 samples for lead and antimony), it appears that the 21,000 µg/g detection of lead was confined to a very small portion of SWMU 20 and soil with low lead levels appear to have been moved to north of the concrete pad.

Appendix D estimates the extent of contamination at SWMU 20, which is shown on Figure 5-2, together with the COC locations that helped define the area and volume of contaminated soil. The estimated total area and volume of contaminated soil to be evaluated for possible active corrective measures are 7,200 square feet (ft^2) and 270 cubic yards (yd^3), respectively. The depth of contamination is assumed to be 1 foot bgs. This estimate is based on soil containing lead concentrations above the quantitative CAO for lead (1,800 µg/g) in surface soil. The additional sampling suggests that the volume of soil containing lead above 1,800 µg/g may be smaller than 270 yd^3. However, it is recommended that the area shown on Figure 5-2 is addressed unless confirmation sampling is performed and determines a smaller or otherwise different extent of contamination.

In addition to the above quantitative CAOs, the CMS Work Plan (Dames & Moore, 2000) presented qualitative CAOs for SWMU 20 to comply with UAC R315-101, as follows:

- To protect other media from further degradation (i.e., to ensure that levels of contamination do not increase beyond existing levels, per UAC R315-101-3).

- To protect human health and the environment in accordance with Federal, State, and local regulatory requirements.

- To ensure that – if the current military land use scenario changes in the future to residential or other use – appropriate measures are taken to adequately protect human health and the environment,.

The CMS Work Plan (Dames & Moore, 2000) identified the following five alternatives to address lead in surface soil at the AED Deactivation Furnace Site:

SWMU 20	Corrective Measures Alternative
AED DEACTIVATION FURNACE SITE	**Land use restrictions** Impose land use restrictions to prevent residential development **Asphalt cover and land use restrictions** Install an asphalt cover over affected area Periodically inspect and maintain asphalt cover Impose land use restrictions to prevent residential development **Excavation, solidification/stabilization, and land use restrictions** Excavate contaminated soil Fill and compact with clean soil Solidify/stabilize excavated soil on post by mixing with chemical reagents Impose land use restrictions to prevent residential development **Excavation, soil washing, and land use restrictions** Excavate contaminated soil Treat excavated soil on post by soil washing and segregate fine soil portion Backfill excavation with treated soil, cover with clean soil, and revegetate Characterize, transport, and treat/dispose of metals-contaminated fine soil fraction off post in accordance with U.S. Army protocols and State and Federal regulations Impose land use restrictions to prevent residential development **Excavation, off-post treatment/disposal, and land use restrictions** Excavate contaminated soil Fill and compact with clean soil Characterize, transport, and treat/dispose of metals-contaminated soil off post in accordance with U.S. Army protocols and State and Federal regulations Impose land use restrictions to prevent residential development

Table 5-1 summarizes the risks to human health and the environment evaluated in the Phase II RFI (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997), and the corrective measures alternatives identified for SWMU 20 in the CMS Work Plan (Dames & Moore, 2000).

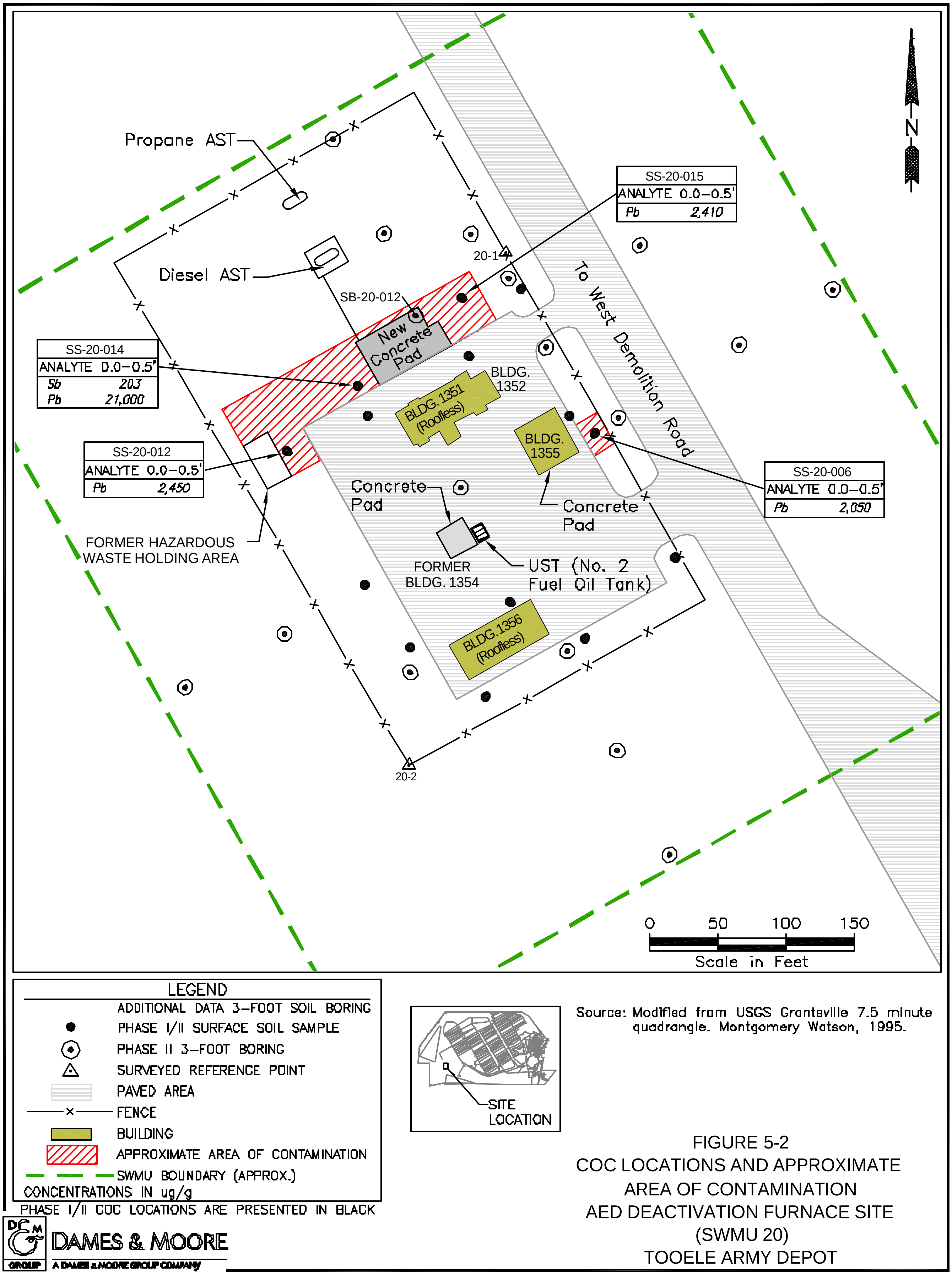

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FIGURE 5-2
COC LOCATIONS AND APPROXIMATE AREA OF CONTAMINATION
AED DEACTIVATION FURNACE SITE
(SWMU 20)
TOOELE ARMY DEPOT

TABLE 5-1

Summary of Phase II RFI, SWERA, and CMS Work Plan
AED Deactivation Furnace Site (SWMU 20)

<table>
<tr><th colspan="9">Phase II RFI (Montgomery Watson, 1997)</th><th>SWERA (Rust E&I, 1997)</th><th colspan="2">CMS Work Plan (Dames & Moore, 2000)</th></tr>
<tr><th colspan="8">Human Health Risk Assessment (a)</th><th>Impacts to Groundwater</th><th>Ecological Risk</th><th>COCs (b)</th><th>Corrective Measures Alternative (c)</th></tr>
<tr><th colspan="4">Hypothetical Future Residential Land Use Scenario (d)</th><th colspan="4">Realistic Future Land Use Scenario (e)</th><td rowspan="4">None</td><td rowspan="4">Moderate</td><td rowspan="4">Surface soil:
Antimony
Lead</td><td rowspan="4">Land use restrictions
Asphalt cover and land use restrictions
Excavation, solidification/ stabilization, and land use restrictions
Excavation, soil washing, and land use restrictions
Excavation, off-post treatment/ disposal, and land use restrictions</td></tr>
<tr><th></th><th>Risk</th><th>HI</th><th>Blood Lead Level (f)</th><th></th><th>Risk</th><th>HI</th><th>Blood Lead Level (f)</th></tr>
<tr><td>Adult</td><td>3×10^{-6}</td><td>NE(g)</td><td>NE</td><td>Military</td><td>9×10^{-7}</td><td>0.2</td><td>5.8</td></tr>
<tr><td>Child</td><td>NE</td><td>10</td><td>15.4</td><td>Construction</td><td>7×10^{-7}</td><td>0.2</td><td>5.3</td></tr>
</table>

(a) Risks, HIs, and blood lead levels that are above comparison levels appear in bold type.
(b) Antimony was detected above its CAO at one location, while lead was detected above its CAO at four locations.
(c) The selected corrective measures alternative appears in bold italic type.
(d) EPA guidance and UAC R315-101-5.2(b)(1) require evaluation of the hypothetical future land use scenario. Because risks and HIs are greater than 1×10^{-6} and 1.0, respectively, EPA guidance and UAC R315-101-6(c)(3) indicate that a CMS must be performed.
(e) EPA guidance and UAC R315-101-5.2(b)(2) require evaluation of the realistic future land use scenario. Because risks and HIs are less than 1×10^{-4} and 1.0, respectively, UAC R315-101-6(d) indicates that management measures and active corrective measures can be evaluated.
(f) Blood lead levels are expressed as micrograms per deciliter (µg/dL) for 95 percent of the population (should not exceed 10 µg/dL).
(g) NE = pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).

5.2 DETAILED EVALUATION OF CORRECTIVE MEASURES ALTERNATIVES

Section 5.2 evaluates the five corrective measures alternatives for the AED Deactivation Furnace Site (SWMU 20). Each of the alternatives includes land use restrictions, which are described in Section 5.2.1. Alternatives 2, 3, 4, and 5 include UXO survey and clearance (described in the CMS Work Plan (Dames & Moore, 2000)) over the areas where corrective actions will occur. Although no UXO was encountered at SWMU 20 during field investigations, a UXO survey will be performed as a safety precaution before intrusive work begins because of past demilitarization procedures at the facility. If UXO is detected in an area requiring intrusive activities, it will be cleared before proceeding.

5.2.1 Alternative 1 – Land Use Restrictions

This corrective measures alternative involves the application of land use restrictions to ensure that the current land use (i.e., military) does not change to residential or other unauthorized use in the future. It includes no active corrective measures. These restrictions would be incorporated into TEAD's master land use plan. This plan also calls for inspections and monitoring to ensure the restrictions are being observed. Because U.S. Army regulations direct that all revisions to this plan be evaluated with regard to potential impacts to human health and the environment, authorization for another (i.e., nonmilitary) use of SWMU 20 would require the resolution of conflicts between identified risks and hazards and proposed changes in land use at the site.

The real property planning board has authority over land use at the base, and is responsible for developing, enforcing, and modifying the installation's master land use plan. The authority of the board is derived from the responsible major Army command (i.e., OSC), which has specific oversight functions. These responsibilities include approving the installation's master land use plan and any proposed changes. Appendix C of the CMS Work Plan (Dames & Moore, 2000) presents a more detailed description of land use restrictions.

Alternative 1 – land use restrictions – is evaluated as follows:

- Technical evaluation

  - Performance – Land use restrictions prevent future residential exposure to contaminants in soil. This corrective measures alternative is applicable to both site and contaminant characteristics, and maintains its effectiveness over time. However, the qualitative and quantitative CAOs developed in the CMS Work Plan (Dames & Moore, 2000) are not achieved, because land use restrictions do not prevent the exposure of Depot workers to lead in soil.

- Reliability – Land use restrictions are effective over the long term and have been implemented at many sites with positive results. However, this alternative does not permanently remove the site contamination. No residential or other unauthorized exposure should occur while the restrictions are in place. No O&M, management of waste materials, or long-term environmental monitoring is required.

- Implementability – Because SWMU 20 is currently under military use, continuing land use restrictions at this site should not be difficult.

- Safety – No intrusive activities are required for implementation of this alternative.

- Human health assessment – Restricting future development of the site protects human health by preventing residential exposure to the previously identified contaminants in soil at SWMU 20. However, the calculated blood lead level remains above the applicable CDC target for current and future Depot workers. The residual risk remaining onsite for soil results from soil contamination at concentrations above military use CAOs, which are the realistic land use CAOs.

- Environmental assessment – This alternative does not reduce ecological risk but the SWERA (Rust E&I, 1997) indicated that SWMU 20 is unlikely to pose excessive or unacceptable risk to ecological receptors as a result of the contaminants in soil.

- Administrative feasibility – Because SWMU 20 is to remain under U.S. Army control, land use restrictions will be administered through the installation's real property planning board. However, this alternative does not meet the requirements of UAC R315-101 because of the exceedance of the CDC target for blood lead.

- Cost – The estimated cost of implementing Alternative 1 is $12,000. Table A-3 (see Appendix A) presents the detailed cost estimate.

5.2.2 Alternative 2 – Asphalt Cover and Land Use Restrictions

This corrective measures alternative includes extension of the existing pavement to cover the lead-contaminated area at SWMU 20 (see Figure 5-2). As discussed in Section 5.1, the estimated total area to be covered by asphalt is 7,200 ft^2. The asphalt pad is approximately 3 inches thick, underlain by a gravel base course approximately 9 inches thick and, if necessary, stabilization geotextile. The pavement is designed to support normal vehicle (e.g., trucks, cars) loads, but not heavy equipment, such as cranes. The cap is designed and installed to prevent the formation of channels of water under the cap and prevent contaminant migration due to drainage culverts. Annual inspections are performed to verify that the asphalt cover has not been damaged. Maintenance is performed as required. In addition, Alternative 2 applies land use restrictions to prevent future residential development at SWMU 20, as described in Section 5.2.1 and UXO survey and clearance prior to capping activities. The land use restrictions will state that contamination removal must be evaluated if the property changes ownership or is used for any purpose that could disturb the cover.

Alternative 2 – asphalt cover and land use restrictions – is evaluated as follows:

- <u>Technical evaluation</u>

  – <u>Performance</u> – The installation of an asphalt cover and the application of land use restrictions comply with UAC-R315-101-3, the "Principle of Non-Degradation," by preventing the migration of lead from soil at the site to other environmental media. Although the soil containing lead concentrations above the quantitative CAO for lead is left in place, Alternative 2 achieves the qualitative CAOs developed in the CMS Work Plan (Dames & Moore, 2000) by preventing human exposure to the contaminated soil. This alternative is applicable to both site and contaminant characteristics; as long as the asphalt cover is properly maintained, it meets the identified CAOs with no decrease in effectiveness over time. Although a cover is not a permanent remedy, the site is still being used, therefore, permanence of corrective measures will be addressed when site closure activities commence at some future date.

  – <u>Reliability</u> – Land use restrictions are effective over the long term and have been implemented at many sites with positive results. However, they do not permanently remove site contamination. Maintenance of the asphalt cover is required to ensure the long-term effectiveness of this alternative. Maintenance requirements should be minimal as long as load restrictions are observed. No Depot worker exposure to the identified contamination will occur while the asphalt cover is in place. The cover is inspected annually. This alternative does not require the management of waste materials or long-term environmental monitoring. Some degree of long-term liability is associated with the contaminated soil covered but still onsite.

  – <u>Implementability</u> – Equipment and materials required for installation of the asphalt cover are readily available. Because the specified future land use for SWMU 20 is continued military use, continuing land use restrictions at this site should not be difficult. Approximately 2 weeks is required to complete site construction activities and to achieve the qualitative CAOs.

  – <u>Safety</u> – Because this alternative does not require excavation or handling of contaminated soil, its implementation poses no significant threat to workers, off-post residential communities, or the environment. However, placement of the asphalt cover requires the use of personal protective equipment and compliance with applicable Occupational Safety and Health Administration (OSHA) regulations. Appropriate precautionary measures such as dust suppression will also be performed.

- Human health assessment – Installing an asphalt cover over contaminated areas and restricting future development of the site protects human health by preventing both short- and long-term exposure to contaminated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – The SWERA (Rust E&I, 1997) indicated that SWMU 20 is unlikely to pose excessive or unacceptable risk to ecological receptors. The installation of an asphalt cover over impacted areas further minimizes potential impacts to the environment by preventing the exposure of ecological receptors to contaminated soil at the site.

- Administrative feasibility – By preventing exposure to contaminated soil, this alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101. SWMU 20 contains an operational permitted facility, and an asphalt cap will protect depot workers without affecting facility activities. The site will be reevaluated during closure of the facility.

- Cost – The estimated present worth cost of implementing Alternative 2 is \$130,000. Table A-4 (see Appendix A) presents the detailed cost estimate.

5.2.3 Alternative 3 – Excavation, Solidification/Stabilization, and Land Use Restrictions

This corrective measures alternative includes excavation of the lead-contaminated soil (see Figure 5-2) to a depth of 1 foot using an excavator, backhoe, or similar equipment. As discussed in Section 5.1, the estimated total volume of contaminated soil to be excavated is 270 yd^3. This alternative includes the collection of confirmatory soil samples from the floor and each sidewall of the excavation, and analysis for lead. A lead soil screening tool such as x-ray fluorescence (XRF) or field laboratory tests may also be used to sample surface soil. Excavation and confirmatory sampling continue until the quantitative CAO for lead (1,800 μg/g) is achieved. Excavation will continue into existing asphalt if warranted based on confirmation samples. Asphalt removed will be sampled before disposal.

The lead-contaminated soil is transported to an on-post location (agreed to by the Army and regulatory agencies), where it is solidified/stabilized and placed in a corrective action management unit (CAMU) at SWMU 12/15 (Known Releases). In this process, cement or other chemicals or a proprietary binding agent is used to solidify and stabilize the homogenized soil. A cement-based process is selected for Alternative 3 because of its versatility in immobilizing both particulate and adsorbed lead. Pretreatment optimization, performed as part of the alternative, may indicate that another solidification/stabilization agent is more effective. Toxicity characteristic leaching procedure (TCLP) is used to evaluate the effectiveness of stabilization. The stabilized soil that meets TCLP standards is then placed within the CAMU, where it is allowed to cure in place.

The objective of solidification/stabilization is to treat the contaminated soil to below applicable regulatory levels (e.g., TCLP). Pretreatment testing is required to evaluate the effectiveness of the technology and to obtain optimum design criteria. Confirmation sampling verifies that the soil is stabilized and regulatory levels are met. Clean soil from an on-post borrow area is backfilled into excavated areas. The backfilled areas are graded and covered with vegetation to prevent surface water ponding and to minimize erosion.

Pretreatment optimization is required prior to final design of the solidification/stabilization alternative to evaluate the effectiveness of this technology on the metals-contaminated soil from the site, and to select the stabilization reagent formulation. TCLP tests are conducted to evaluate the ability of the solidification/stabilization process to convert the contaminated soil to a nonhazardous material in accordance with RCRA. The tests are expected to produce information on the strength, durability, volume increase, and long-term integrity of the stabilized material, and on design criteria for the treatment process. For purposes of the CMS, it is assumed that Portland cement is the primary reagent to be used, and that the volume increase due to treatment of the soil is 20 percent. Five year inspections – to include sample collection and analysis – are conducted to confirm the long-term effectiveness of the solidification/stabilization process.

Alternative 3 also includes land use restrictions to prevent future residential development at SWMU 20, as described in Section 5.2.1, and UXO survey and clearance prior to excavation activities.

Alternative 3 – excavation, solidification/stabilization, and land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – The treatment of contaminated soil by solidification/stabilization and the application of land use restrictions comply with UAC R315-101-3, the "Principle of Non-Degradation," by preventing the migration of lead from soil at the site to other environmental media. The qualitative CAOs developed in the CMS Work Plan (Dames & Moore, 2000) are expected to be achieved by protecting human health and the environment by immobilizing lead in the treated soil. This alternative is applicable to both site and contaminant characteristics and is likely to meet the identified CAOs with no decrease in effectiveness over time. In addition, the land use restrictions prevent future residential development and potential exposure to lead and other contaminants in untreated soil at the site.

This alternative requires pretreatment testing to confirm the effectiveness of solidification/stabilization for classifying the metals-contaminated soil as nonhazardous based on TCLP test results. Although solidification/ stabilization is considered to be a permanent treatment process, there is a potential for the eventual breakdown of the material and release of contained metals. The pretreatment optimization is expected to more clearly quantify this potential.

– Reliability – Solidification/stabilization and land use restrictions are expected to be effective over the long term, and have been implemented effectively at many sites. Land use restrictions should prevent future residential exposure to contaminated soil at the site. Management of waste materials is limited to contaminated soil. Pretreatment testing confirms whether solidification/stabilization can achieve the CAOs. Some degree of long-term liability may be associated with return of the stabilized soil to the CAMU at SWMU 12/15 (Known Releases). Five-year inspections are conducted to confirm the long-term effectiveness of the solidification/stabilization process.

– Implementability – Excavation equipment for this alternative is readily available. However, the number of vendors with experience in using this treatment method for contaminated soil may be limited. Because Alternative 3 requires excavation, the presence of subsurface utilities may also affect its implementation. Continuing land use restrictions should not be difficult because the specified future land use for SWMU 20 is continued military use. Approximately 1 to 2 months is likely needed to complete the excavation, solidification/stabilization, and backfilling activities, and to meet the CAOs.

– Safety – This alternative poses low short-term risks to onsite workers, who may be exposed to lead-contaminated soil during excavation and solidification/stabilization operations. However, it includes appropriate precautionary measures, as necessary (e.g., dust suppression and personal protective equipment).

- Human health assessment – Excavating and solidifying/stabilizing contaminated soil, and restricting future residential development of the site, protect human health by preventing both short- and long-term exposure to untreated soil. The residual risk remaining onsite results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – The SWERA (Rust E&I, 1997) indicated that SWMU 20 is unlikely to pose excessive or unacceptable risk to ecological receptors. This alternative further minimizes risk.

- Administrative feasibility – This alternative likely complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by treating impacted soil and thereby reducing the risk to human health. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust. Excavation of soil may disrupt facility operations. Obtaining permission to place stabilized soil at SWMU 12/15 may present administrative difficulties.

- Cost – The estimated present worth cost of implementing Alternative 3 is $270,000. Table A-5 (see Appendix A) presents the detailed cost estimate.

5.2.4 Alternative 4 – Excavation, Soil Washing, and Land Use Restrictions

This corrective measures alternative includes excavation of the lead-contaminated soil (see Figure 5-2) to a depth of 1 foot using an excavator, backhoe, or similar equipment. As discussed in Section 5.1, the estimated total volume of contaminated soil to be excavated is 270 yd^3. This alternative includes the collection of confirmatory soil samples from the floor and each sidewall of the excavation, and analysis for lead. A lead soil screening tool such as XRF or field laboratory tests may also be used to sample surface soil. Excavation and confirmatory sampling continue until the quantitative CAO for lead (1,800 µg/g) is achieved. Excavation will continue into existing asphalt if warranted based on confirmation samples. Asphalt removed will be sampled before disposal.

The excavated soil is treated onsite by soil washing, which separates the lead-contaminated soil into coarse and fine fractions. Screens are used to remove large rocks and other debris; water or proprietary solution is then added to a trommel or other size classification device, where the soil is separated into coarse- and fine-grained particles.

Most of the lead present in contaminated soil is concentrated in the fines, which may be further treated using an acid leach. However, if the fines cannot be treated to cleanup objectives, the soil is sent offsite for treatment/disposal. Because the lead concentrations are expected to be high, it is assumed that the fines are classified as hazardous waste in accordance with applicable RCRA criteria (i.e., TCLP), and that they are shipped off post for disposal at a Subtitle C hazardous waste landfill. The fines are expected to require pretreatment (i.e., stabilization) at the selected treatment, storage, and disposal (TSDF) facility to comply with RCRA land disposal restrictions (LDRs) prior to disposal in the landfill.

Large rocks, debris, and coarse-grained particles that meet applicable TCLP levels for lead and other contaminants are returned to the areas from which they were excavated. In addition, clean soil from an on-post borrow area is backfilled into the excavated areas, as necessary. The backfilled areas are then graded and covered with a 6 inch vegetated soil cover built to prevent surface water ponding and to minimize erosion. If the soil washwater or proprietary solution contains excessive amounts of lead or other contaminants, it is treated onsite using ion exchange resins or another appropriate treatment method.

Pretreatment testing is required prior to final design of this alternative to evaluate the effectiveness of this technology on soil from SWMU 20 and to develop optimal process design criteria.

Alternative 4 also includes land use restrictions to prevent future residential development at SWMU 20, as described in Section 5.2.1, and UXO survey and clearance prior to excavation activities.

Alternative 4 – excavation, soil washing, and land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – Excavation and soil washing of lead-contaminated soil are likely to meet both the quantitative and qualitative CAOs (see Section 5.4.1) developed in the CMS Work Plan (Dames & Moore, 2000). This alternative complies with UAC R315-101-3, the “Principle of Non-Degradation,” by treating the lead-contaminated soil. In addition, land use restrictions prevent future residential development and potential exposure to residual contaminants in soil. Alternative 4 meets the identified CAOs with no decrease in effectiveness over time; however, the effectiveness of soil washing needs to be determined by pretreatment testing. If the percentage of fines in the contaminated soil is greater than approximately 30 percent, the effectiveness of soil washing may be limited.

  – Reliability – Soil washing and land use restrictions are effective over the long term, and have been implemented effectively at many sites. This corrective measures alternative eliminates Depot worker exposure to contaminated soil at the site and prevents potential future residential exposure to residual contaminants. After the washed material has been backfilled in the excavated areas, no additional management of waste materials or long-term environmental monitoring is required. However, some degree of long-term liability is associated with the placement of contaminated fine-grained particles in a landfill.

  – Implementability – Equipment for excavation and soil washing are readily available, and a Subtitle C landfill and TSDF are located within 100 miles of TEAD. Because this alternative requires excavation, the possible presence of subsurface utilities may affect its implementation.

Continuing land use restrictions at this site should not be difficult, because the specified future land use for SWMU 20 is continued military use. The number of vendors experienced in using this treatment technology is limited. Approximately 1 month is required to complete the excavation, soil washing, and backfilling activities, and to meet the CAOs.

– Safety – Alternative 4 poses moderate short-term risks to off-post residential communities and onsite workers. Residential communities may be exposed to lead-contaminated soil during transportation and off-post treatment/disposal of residuals. Onsite workers may be exposed to lead-contaminated soil during excavation, soil washing, and other soil-handling activities. However, the alternative includes appropriate precautionary measures, as necessary (e.g., dust suppression and personal protective equipment).

- Human health assessment – Excavating and washing contaminated soil, and restricting future residential development of the site, protect human health by preventing both short- and long-term exposure to contaminated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – The SWERA (Rust E&I, 1997) indicated that SWMU 20 does not present an excessive or unacceptable risk to ecological receptors. This alternative further minimizes risk.

- Administrative feasibility – This alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by using soil washing to reduce the concentrations of lead in soil. Because lead concentrations are reduced to meet the applicable quantitative CAO, this alternative meets the human health risk criterion under UAC R315-101-6. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust. The excavated soil that is shipped off post is transported in accordance with U.S. Department of Transportation (DOT) regulations. Excavation of soil may disrupt facility operations.

- Cost – The estimated present worth cost for implementing Alternative 4 is $280,000. Table A-6 (see Appendix A) presents the detailed cost estimate.

5.2.5 Alternative 5 – Excavation, Off-Post Treatment/Disposal, and Land Use Restrictions

This corrective measures alternative includes excavation of the lead-contaminated soil (see Figure 5-2) to a depth of 1 foot using an excavator, backhoe, or similar equipment. As discussed in Section 5.1, the estimated total volume of contaminated soil to be excavated is 270 yd^3. This alternative includes the collection of confirmatory soil samples from the floor and each sidewall of the excavation, and analysis for lead. A lead screening tool such as XRF or field laboratory tests may also be used to sample surface soil. Excavation and confirmatory sampling continue until the quantitative CAO for lead (1,800 μg/g) is achieved. Excavation will continue into existing asphalt if warranted based on confirmation samples. Asphalt removed will be sampled before disposal.

The excavated soil undergoes a soil profile analysis to determine if the soil exhibits a listed or characteristic RCRA hazardous waste. A preliminary review of the site contaminants and potential waste processes contributing to the contamination at SWMU 20 suggest that the metals in soil are not listed wastes. However, the contaminant data suggests that lead may exceed TCLP regulatory levels and the soil will therefore exhibit a RCRA characteristic waste. A final waste determination will be made during the corrective action phase. A review of other regulations (e.g., State of Utah, DOT) and additional testing (e.g., TCLP) will be necessary to make this determination.

If the soil is classified as containing a hazardous waste in accordance with RCRA or other applicable criteria, it is transported to an off-post Subtitle C hazardous waste landfill for direct disposal (if contaminant concentrations meet land disposal restrictions (LDR) guidelines) or to a transportation, storage, and disposal facility (TSDF) for treatment prior to disposal. For purposes of this CMS, it is assumed that the lead-contaminated soil is sent to a TSDF for pretreatment by solidification/stabilization to comply with applicable RCRA LDRs prior to disposal in the landfill. However, if the soil profile results are acceptable, the soil could be sent to an off-post Subtitle D landfill for disposal. The excavated soil is transported and manifested in compliance with applicable regulations. Clean soil from an on-post borrow site is backfilled into the excavated areas, upon which are placed graded vegetative covers to prevent surface water ponding and to minimize erosion.

Alternative 5 also includes land use restrictions to prevent future residential development at SWMU 20, as described in Section 5.2.1, and a UXO survey and clearance prior to excavation activities.

Alternative 5 – excavation, off-post treatment/disposal, and land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – Excavation and off-post treatment/disposal of lead-contaminated soil meet both the qualitative and quantitative CAOs (see Section 5.1) developed in the CMS Work Plan (Dames & Moore, 2000). This alternative also complies with UAC R315-101-3, the "Principle of Non-Degradation," by removing the contaminated soil from the site. Alternative 5 meets the identified CAOs with no decrease in effectiveness over time. In addition, land use restrictions prevent future residential development of SWMU 20 and potential exposure to residual contaminants in soil.

– Reliability – Excavation and off-post treatment/disposal, and land use restrictions, are effective over the long term and have been implemented effectively at many sites. This corrective measures alternative eliminates Depot worker exposure to contaminated soil at the site and prevents potential future residential exposure to residual contaminants. No management of waste materials or long-term environmental monitoring is required at SWMU 20. However, some degree of long-term liability is associated with the disposal of contaminated soil in an off-post landfill. Management and monitoring are required at the landfill.

– Implementability – Excavation equipment for this alternative is readily available, and a Subtitle C landfill and TSDF are located within 100 miles of TEAD. Because Alternative 5 requires excavation, the possible presence of subsurface utilities may affect its implementation. Continuing land use restrictions at this site should not be difficult because the specified future land use for SWMU 20 is continued military use. Approximately 2 to 3 weeks is required to complete the excavation, off-post transportation/disposal activities, and backfilling, and to meet the CAOs.

– Safety – Alternative 5 poses moderate short-term risks to off-post residential communities and onsite workers. Residential communities may be exposed to lead-contaminated soil during transportation and off-post treatment/disposal of the soil. Onsite workers may be exposed to lead-contaminated soil during excavation and other soil handling activities. However, the alternative includes appropriate precautionary measures, as necessary (e.g., dust suppression and personal protection equipment).

- Human health assessment – Excavation and off-post treatment/disposal of contaminated soil, and restriction of future residential development of the site, protect human health by preventing both short- and long-term exposure to soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residual use CAOs.

- Environmental assessment – The SWERA (Rust E&I, 1997) indicated that SWMU 20 is unlikely to pose excessive or unacceptable risk to ecological receptors. This alternative further minimizes risk.

- Administrative feasibility – This alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by removing lead-contaminated soil from the site. Because all soil containing lead levels above the CAO for lead is excavated and removed from SWMU 20, Alternative 5 meets the human health risk criteria under UAC R315-101-6. Contaminated soil is excavated in accordance with UAC

R307-12, Fugitive Emissions and Fugitive Dust. The excavated soil is transported in accordance with DOT regulations. Excavation of soil may disrupt facility operations.

- Cost – The estimated present worth cost of implementing Alternative 5 is \$200,000. Table A-7 (see Appendix A) presents the detailed cost estimate.

5.3 COMPARATIVE ANALYSIS OF CORRECTIVE MEASURES ALTERNATIVES

Table 5-2 and the text below summarize the comparative analysis of the five corrective measures alternatives developed for the AED Deactivation Furnace Site (SWMU 20).

- Technical evaluation

  – Performance – Alternative 5 (excavation, off-post treatment/disposal, and land use restrictions) meets both the qualitative and quantitative CAOs and is rated high with respect to performance. Alternative 3 (excavation, solidification/stabilization, and land use restrictions) and Alternative 4 (excavation, soil washing, and land use restrictions) meet both the qualitative and quantitative CAOs, but require pretreatment testing and are rated moderate with respect to performance. Alternative 2 (asphalt cover and land use restrictions) is rated moderate for performance because it is not a permanent remedy and it only meets the CAOs if the cover is properly maintained. Alternative 1 (land use restrictions) is rated low because it does not meet CAOs.

  – Reliability – Alternative 5 is rated high for reliability because it has been proven effective at other sites, and no O&M activities or long-term monitoring is required. Alternative 2 is rated moderate because it does not permanently remove site contamination, and it requires annual inspection and maintenance of the asphalt cover. Alternatives 3 and 4 are rated moderate because pretreatment testing is required to further evaluate their effectiveness and permanence, and 5-year site inspections are recommended to ensure the long-term effectiveness of the solidification/stabilization process. Alternative 1 is rated moderate because it has been proven effective at other sites to prevent residential use; however, it does not permanently remove site contamination, and it does not address Depot personnel exposure to lead-contaminated soil.

  – Implementability – Alternatives 1, 2, and 5 are rated high because they are easy to implement. Equipment, materials, and contractors required to implement Alternatives 2 and 5 are readily available locally. In addition, it is estimated that Alternatives 2 and 5 could each be completed within 2 to 3 weeks. Alternatives 3 and 4 are rated moderate because there are

TABLE 5-2

Comparative Analysis of Corrective Measures Alternatives
AED Deactivation Furnace (SWMU 20) (a)

Corrective Measures Alternative	Technical Evaluation				Human Health Assessment	Environmental Assessment	Administrative Feasibility	Cost
	Performance	Reliability	Implementability	Safety				
1 - Land use restrictions	Low	Moderate	High	High	Low	Moderate	Low	$12,000
2 - Asphalt cover and land use restrictions	Moderate	Moderate	High	High	High	High	High	$130,000
3 - Excavation, solidification/ stabilization, and land use restrictions	Moderate	Moderate	Moderate	Moderate	High	High	Moderate	$270,000
4 - Excavation, soil washing, and land use restrictions	Moderate	Moderate	Moderate	Moderate	High	High	Moderate	$280,000
5 - Excavation, off-post treatment/disposal, and land use restrictions	High	High	High	Moderate	High	High	Moderate	$200,000

(a) Rankings indicate how well each alternative meets the evaluation criteria, relative to other alternatives.

fewer contractors experienced in performing these treatment processes; Alternative 4 requires approximately 1 month for implementation, and Alternative 3 requires 1 to 2 months.

– Safety – Alternatives 1 and 2 are rated high for safety because they do not require the excavation and handling of contaminated soil; therefore, they do not present a significant short-term risk to the surrounding community or on-post workers. Alternative 3 is rated moderate because – though it involves the excavation and treatment of contaminated soil – it does not include the off-post transport of hazardous materials. Alternatives 4 and 5 involve the excavation and handling of contaminated soil at the site, and the off-post shipment of either the soil or the soil-washing treatment residuals to a Class C landfill or TSDF. Each of these alternatives receives a moderate rating for safety.

- Human health assessment – Alternatives 2, 3, 4, and 5 receive a high rating for this criterion because they are protective of human health. Alternative 2 protects human health by containing the COCs at the site beneath the asphalt cover. Alternatives 3 and 4 use solidification/stabilization or soil washing to reduce COC concentrations in the affected soil. Alternative 5 removes the contaminated soil from SWMU 20. Alternative 1 is rated low for human health because the elevated blood lead level estimated for Depot workers is not reduced to meet the applicable CDC target.

- Environmental assessment – Alternatives 2, 3, 4, and 5 each receive a high rating for this criterion because they reduce risk to ecological receptors. Alternative 1 is rated moderated because although it does not reduce ecological risk, the SWERA concluded that the ecological risks at SWMU 20 do not warrant corrective measures.

- Administrative feasibility – Alternative 2 is rated high for administrative feasibility because it is expected to meet the requirements of UAC R315-101. Alternatives 3, 4, and 5 are also expected to meet these requirements, but receive a moderate rating because soil excavation may disrupt facility operations and Alternatives 3 and 4 may require a RCRA treatment permit. Alternative 1 fails to meet regulatory requirements because of exceedance of the CDC target for blood lead levels in Depot workers. It receives a low rating.

- Cost – The estimated cost of Alternative 1 is $12,000. Of the four active corrective measures alternatives, Alternative 2 has the lowest cost, estimated at $130,000. The estimated costs of Alternatives 3, 4, and 5 are $270,000, $280,000, and $200,000, respectively.

5.4 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVE

Based on the comparative analysis presented in Section 5.3, Alternative 2 – asphalt cover and land use restrictions – is recommended as the preferred alternative for SWMU 20 because:

- It meets the qualitative CAOs, including protection of human health and the environment and compliance with the “Principle of Non-Degradation” under UAC R315-101-3.

- It has been demonstrated at other sites.

- It is reliable and easy to implement.

- It is safer to implement than the other active corrective measures alternatives, because it does not require excavation and handling of contaminated soil.

- It can be implemented at a much lower cost than the other active corrective measures alternatives.

6.0 DEACTIVATION FURNACE BUILDING (SWMU 21)

Section 6.0 evaluates corrective measures alternatives for the Deactivation Furnace Building (SWMU 21; Figure 6-1). Data from the CMS Work Plan (Dames & Moore, 2000), the human health RA (Montgomery Watson, 1997), and the SWERA (Rust E&I, 1997) are also summarized below.

6.1 SUMMARY OF RAs AND CMS WORK PLAN

Figure 6-1 shows the location and layout of the Deactivation Furnace Building Site (SWMU 21), which occupies 0.7 acre in the southwestern portion of TEAD. SWMU 21 is an ammunition demilitarization production facility (Building 1320) that was constructed about 1955 (NUS, 1987) and currently operates under a RCRA Part B permit. The areas that are being proposed for corrective measures were contaminated prior to the facility becoming a permitted unit. Current operations do not add to the previous contamination.

Building 1320 contains a rotary-kiln deactivation furnace that is used to deactivate small arms ammunition, primers, and fuses (Rhea, 1990). Air pollution control equipment was installed around 1975 to treat emissions from the furnace (Rhea, 1990). Incinerator residue (ash and metal debris) is collected at the south end of the furnace and loaded into 55-gallon drums for temporary storage. Open staging areas for support equipment and drums are located around the outside of the building. These areas are paved with concrete or covered with gravelly soil.

The Phase II RFI (Montgomery Watson, 1997) identified unacceptable risks, hazards, and blood lead levels to human health at SWMU 21 under the hypothetical future residential land use scenario. Therefore, according to EPA guidance and UAC R315-101-6(c)(3), this SWMU is included in the CMS process, and corrective measures must be evaluated. In addition, unacceptable hazards and blood lead levels were identified for the realistic future military and construction worker scenarios. Therefore, according to UAC R315-101-6(e), active corrective measures are required at this site.

No groundwater monitoring was conducted at SWMU 21. However, according to the Phase II RFI (Montgomery Watson, 1997), the site constituents are not expected to affect groundwater based on the tendency of most COPCs at the site to strongly adsorb to soil, low precipitation rates, high evaporation rates, alkaline soil conditions, and depth to groundwater (which is estimated to be 400 feet bgs).

The SWERA (Rust E&I, 1997) concluded that the contaminants detected in soil at the site pose "the potential for excessive or unacceptable ecological risks to soil fauna, passerine birds, small mammals, and plants, despite [SWMU 21's] small size." Thus, the SWERA recommended that the CMS consider ecological risks in assessing corrective measures, in addition to human health risks. Ecological risk drivers are discussed in Appendix B. As presented in Section 6.2, the evaluation of corrective measures alternatives for SWMU 21 includes assessment of the ability of each alternative to reduce ecological risks to acceptable levels.

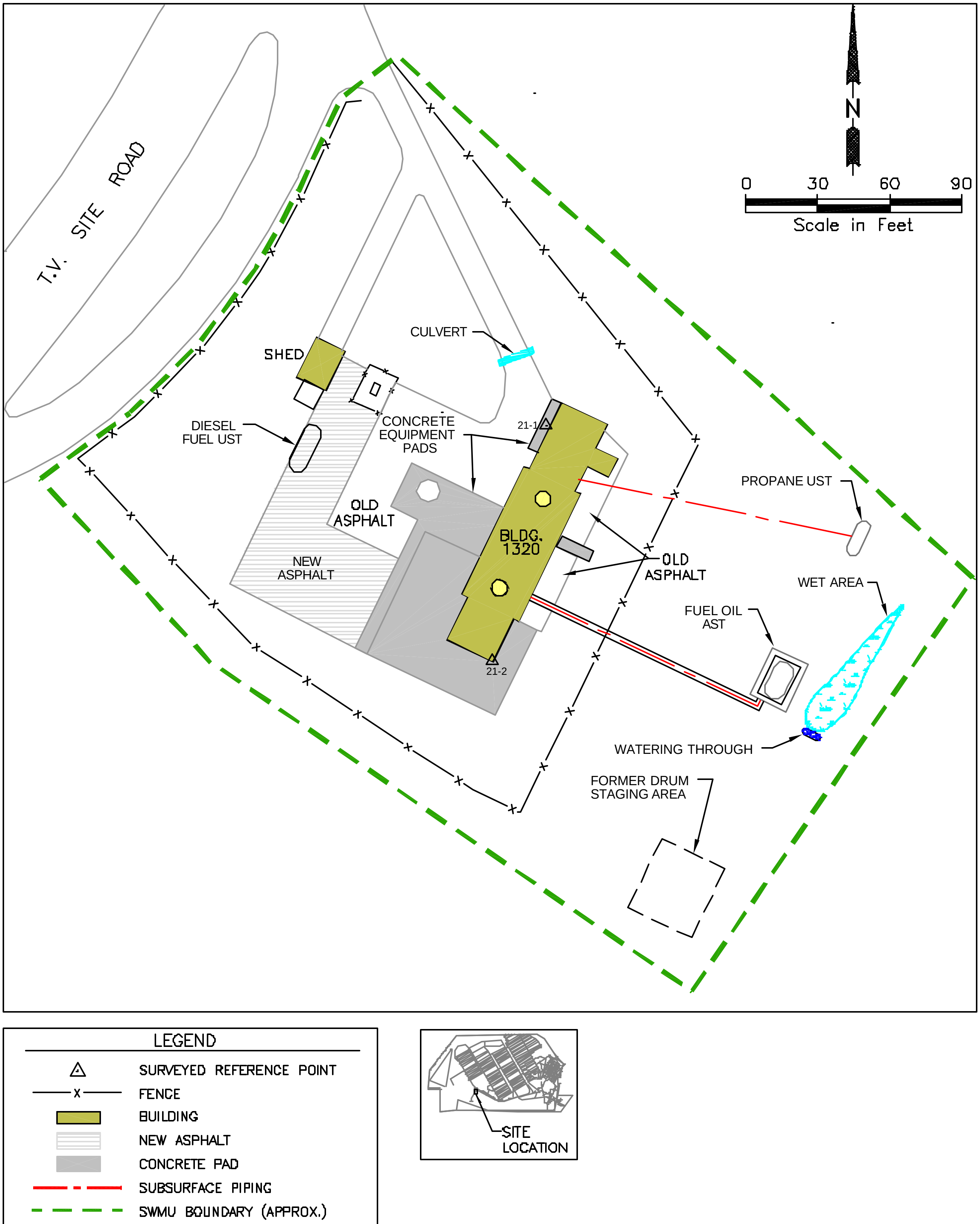
The CMS Work Plan (Dames & Moore, 2000) identified COCs by comparing the maximum concentration of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) to the respective quantitative CAO. Based on this evaluation, antimony, arsenic, beryllium, cadmium, lead, dioxins/furans, and hexachlorodibenzo-p-dioxins (HxCDDs) were determined to be COCs for surface soil. No COCs were identified for subsurface soil.

The following table shows the maximum concentrations and EPCs of the identified COCs in surface soil compared to the CAOs:

Deactivation Furnace Building (SWMU 21)			
COC	**Maximum Concentration (µg/g)**	**EPC (µg/g)**	**CAO (µg/g)**
Antimony	788	304	160
Arsenic	43	17.4	32
Beryllium	3.8	1.63	1.5
Cadmium	904	411	220
Lead	63,000	25,000	1,800
Dioxins/furans	1.7×10^{-4}	9.1×10^{-6}	1.5×10^{-5}
HxCDDs	4.7×10^{-4}	$< 9.1 \times 10^{-6}$	3.7×10^{-4}

These COCs were evaluated in conjunction with the results of the human health RA to further assess the need for active corrective measures. As stated in the Phase II RFI (Montgomery Watson, 1997), the human health RA used the EPC, which represents the likely concentration that an individual would be exposed to by working in the area of the SWMU, to calculate human health risks. The EPC for each COC was compared to the respective CAO, as shown above.

Based on this comparison, which is described in detail in the CMS Work Plan (Dames & Moore, 2000), the human health risks associated with arsenic, dioxins/furans, and HxCDDs under the realistic future land use scenario were concluded to be negligible. As indicated above, the EPC for lead is nearly 14 times as high as the CAO for lead, which was exceeded at eight of the locations where soil samples were collected. The detected concentrations of lead in surface soil at the site were estimated to result in blood lead levels above the applicable CDC target for both Depot and construction workers. The EPCs for antimony and cadmium were each approximately 1.9 times as high as their respective CAOs, resulting in an unacceptable human health risk (i.e., HI above 1.0) at SWMU 21. The EPC for beryllium is slightly above its corresponding CAO. Based on this evaluation, the CMS Work Plan identified active corrective measures (i.e., treatment technologies) as well as management measures to address antimony, beryllium, cadmium, and lead in surface soil.



Source: Modified from USGS Grantsville 7.5 minute quadrangle. Montgomery Watson, 1995.

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FIGURE 6-1
DEACTIVATION FURNACE BUILDING
(SWMU 21)
TOOELE ARMY DEPOT

In December 1999, additional soil samples were collected at SWMU 21 and analyzed for metals to define the horizontal and vertical extent of contamination. Appendix D discusses these additional data collection activities. The additional soil samples (locations shown on Figure 6-2) identified no additional COCs, but additional COC locations for antimony, arsenic, and lead were identified in surface soil. No COCs were identified for subsurface soil.

Figure 6-2 shows the estimated extent of soil contamination at SWMU 21, together with the Phase II and additional data COC locations that define the area and volume of contaminated soil. The maximum lead detection from the additional data is 10,800 µg/g, which is much lower than the maximum lead concentration from the Phase II investigation (63,000 µg/g). In both rounds of sampling lead was detected above its CAO at sample locations surrounding Building 1320, but the highest detected concentrations were generally found closest to the building. The extent of lead contamination above COCs is bounded by additional samples with lead below its CAO on all sides of Building 1320. An isolated lead COC of 3,820 µg/g in SB2109 lies in the northwest corner of SWMU 21. This boring is isolated from other contaminated areas; there are samples with lead below its CAO between it and Building 1320.

The COC locations for the other additional data and Phase II contaminants are generally located within the previously determined extent of contamination. A single arsenic CAO exceedance at SB2111 lies beyond this area.

The estimated total area and volume of contaminated soil to be evaluated for possible corrective actions are 15,300 ft^2 and 850 yd^3, respectively. The estimated area of contaminated soil does not include Building 1320 or the concrete pads. The afterburner equipment pads were poured in August 1999 and are 2 feet thick; any contaminated soil was excavated and properly disposed of during construction activities. The depth of soil contamination in each of the identified areas is assumed to be 1.5 feet bgs. Within the 15,300-ft^2 area of contamination, approximately 2,200 ft^2 is covered with newly paved asphalt.

In addition to the above quantitative CAOs, the CMS Work Plan (Dames & Moore, 2000) presented qualitative CAOs for SWMU 21 to comply with UAC R315-101, as follows:

- To protect other media from further degradation (i.e., to ensure that levels of contamination do not increase beyond existing levels, per UAC R315-101-3).
- To protect human health and the environment in accordance with Federal, State, and local regulatory requirements.
- To ensure that – if the current military land use scenario changes in the future to residential or other use – appropriate measures are taken to adequately protect human health and the environment.

The CMS Work Plan (Dames & Moore, 2000) identified four alternatives to address antimony, beryllium, cadmium, and lead in surface soil at the Deactivation Furnace Building, as follows:

SWMU 21	Corrective Measures Alternative
DEACTIVATION FURNACE BUILDING	**Asphalt cover and land use restrictions** Install an asphalt cover over affected area Periodically inspect and maintain cover Impose land use restrictions to prevent residential development **Excavation, solidification/stabilization, and land use restrictions** Excavate contaminated soil Fill and compact with clean soil Solidify/stabilize excavated soil on post by mixing with chemical reagents Impose land use restrictions to prevent residential development
	Excavation, soil washing, and land use restrictions Excavate contaminated soil Treat excavated soil on post by soil washing and segregate fine soil portion Backfill excavation with treated soil and cover with clean soil Characterize, transport, and treat/dispose of metals-contaminated fine soil fraction off post in accordance with U.S. Army protocols and State and Federal regulations Impose land use restrictions to prevent residential development **Excavation, off-post treatment/disposal, and land use restrictions** Excavate contaminated soil Fill and compact with clean soil Characterize, transport, and treat/dispose of metals-contaminated soil off post in accordance with U.S. Army protocols and State and Federal regulations Impose land use restrictions to prevent residential development

Table 6-1 summarizes the risks to human health and the environment evaluated in the Phase II RFI (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997), and the corrective measures alternatives identified for SWMU 21 in the CMS Work Plan (Dames & Moore, 2000).

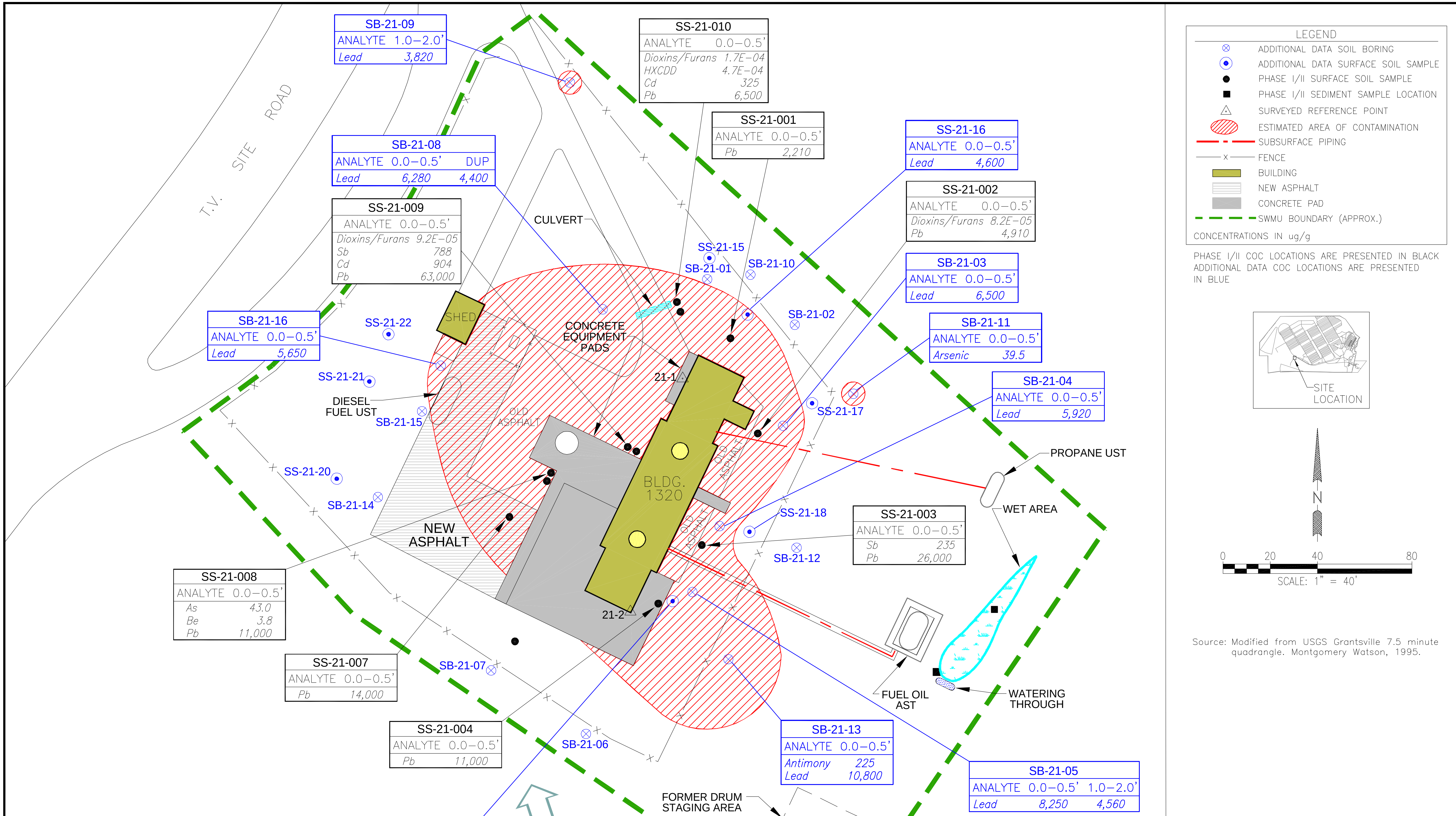

FIGURE 6-2
COC LOCATIONS AND APPROXIMATE AREA OF CONTAMINATION
DEACTIVATION FURNACE BUILDING
(SWMU 21)
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TABLE 6-1

Summary of Phase II RFI, SWERA, and CMS Work Plan
Deactivation Furnace Building (SWMU 21)

Phase II RFI (Montgomery Watson, 1997)									**SWERA (Rust E&I, 1997)**	**CMS Work Plan (Dames & Moore, 2000)**	
Human Health Risk Assessment (a)								**Impacts to Groundwater**	**Ecological Risk**	**COCs (b)**	**Corrective Measures Alternative (c)**
Hypothetical Future Residential Land Use Scenario (d)				**Realistic Future Land Use Scenario (e)**				None	Potentially unacceptable	Surface soil: Antimony, Arsenic, Beryllium, Cadmium, Lead, Dioxins/furans, HxCDDs	***Asphalt cover and land use restrictions*** Excavation, solidification/ stabilization, and land use restrictions Excavation, soil washing, and land use restrictions Excavation, off-post treatment/ disposal, and land use restrictions
	Risk	**HI**	**Blood Lead Level (f)**		**Risk**	**HI**	**Blood Lead Level (f)**				
Adult	$\mathbf{8{\times}10^{-5}}$	NE (g)	NE	Military	$1{\times}10^{-5}$	**3**	**35**				
Child	NE	**30**	**77**	Construction	$6{\times}10^{-6}$	**10**	**55**				

(a) Risks, HIs, and blood lead levels that are above comparison levels appear in bold type.
(b) Because the EPC for beryllium is only slightly higher than its CAO, and because it was detected at only a single location, no active corrective measures are considered to address beryllium. In addition, arsenic and dioxins/furans result in negligible risk to human health.
(c) The selected corrective measures alternative appears in bold italic type.
(d) EPA guidance and UAC R315-101-5.2(b)(1) require evaluation of the hypothetical future land use scenario. Because risks and HIs are greater than $1{\times}10^{-6}$ and 1.0, respectively, EPA guidance and UAC R315-101-6(c)(3) indicate that a CMS must be performed.
(e) EPA guidance and UAC R315-101-5.2(b)(2) require evaluation of the realistic future land use scenario. Because the HI is above the regulatory goal of 1.0, UAC R315-101-6(e) indicates that active corrective measures must be evaluated.
(f) Blood lead levels are expressed as micrograms per deciliter (µg/dL) for 95 percent of the population (should not exceed 10 µg/dL).
(g) NE = pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).

6.2 DETAILED EVALUATION OF CORRECTIVE MEASURES ALTERNATIVES

Section 6.2 evaluates the four corrective measures alternatives for the Deactivation Furnace Building (SWMU 21). Each of the alternatives includes land use restrictions, which are described in detail in Section 6.2.1. Alternatives 1, 2, 3, and 4 include UXO survey and clearance (described in the CMS Work Plan (Dames & Moore, 2000)) over the areas where corrective actions will occur. Although no UXO was encountered at SWMU 21 during field investigations, a UXO survey will be performed as a safety precaution before intrusive work begins because demilitarization procedures for ammunition have been performed at the facility. If UXO is detected in an area requiring intrusive activities, it will be cleared before proceeding.

6.2.1 Alternative 1 – Asphalt Cover and Land Use Restrictions

This corrective measures alternative includes extension of the existing pavement to cover the affected area at SWMU 21 (see Figure 6-2). As discussed in Section 6.1, the total area to be covered by asphalt is estimated to be 13,100 ft^2. A UXO survey and clearance is performed prior to capping activities. The asphalt pad is approximately 3 inches thick, underlain by a liner, a gravel base course approximately 9 inches thick and, if necessary, stabilization geotextile. The pavement is designed to support normal vehicle (e.g., trucks, cars) loads, but not heavy equipment, such as cranes. The area of older asphalt is repaved (gravel subbase not necessary) and the area of asphalt paved in 1999 is inspected and repaired where necessary. The cap is designed and installed to prevent the formation of channels of water under the cap and prevent contaminant migration due to drainage culverts. Annual inspections are conducted to verify that the asphalt cover has not been damaged. Maintenance is performed as necessary.

In addition, this corrective measures alternative also applies land use restrictions to prevent future residential development at SWMU 21. These restrictions would be incorporated into TEAD's master land use plan. This plan also calls for inspections and monitoring to ensure the restrictions are being observed. Because U.S. Army regulations direct that all revisions to this plan be evaluated with regard to potential impacts to human health and the environment, authorization for another (i.e., nonmilitary) use of SWMU 21 would require the resolution of conflicts between identified risks and hazards and proposed changes in land use at the site.

The real property planning board has authority over land use at the base, and is responsible for developing, enforcing, and modifying the installation's master land use plan. The authority of the board is derived from the responsible major Army command (i.e., OSC), which has specific oversight functions. These responsibilities include approving the installation's master land use plan and any proposed changes. Appendix C of the CMS Work Plan (Dames & Moore, 2000) presents a more detailed description of land use restrictions. The land use restrictions will state that contamination removal must be evaluated if the property changes ownership or is used for any purpose that could disturb the cover.

Alternative 1 – asphalt cover and land use restrictions – is evaluated as follows:

- Technical evaluation

  - Performance – The installation of an asphalt cover and the application of land use restrictions comply with UAC R315-101-3, the "Principle of Non-Degradation," by preventing the migration of antimony, beryllium, cadmium, and lead from soil to other environmental media. Although the soil containing concentrations of these metals above their respective quantitative CAOs is left in place, Alternative 1 achieves the qualitative CAOs developed in the CMS Work Plan (Dames & Moore, 2000) by preventing human exposure to the contaminated soil. This alternative is applicable to both site and contaminant characteristics; as long as the asphalt cover is properly maintained, it meets the identified CAOs with no decrease in effectiveness over time. Although a cover is not a permanent remedy, the site is still being used, therefore, permanence of corrective measures will be addressed when site closure activities commence at some future date.

  - Reliability – Maintenance and annual inspection of the asphalt cover are required to ensure the long-term effectiveness of this alternative. These maintenance requirements should be minimal, as long as load restrictions are observed. No Depot worker exposure to the identified contamination will occur while the asphalt cover is in place. Land use restrictions are effective over the long term and have been implemented at many sites with positive results; however, they do not offer a permanent remedy for site contamination. Alternative 1 does not require the management of waste materials or long-term environmental monitoring. Some degree of long-term liability is associated with the covered contaminated soil left onsite.

  - Implementability – Equipment and materials required for installation of the asphalt cover are readily available. Because the specified future land use for SWMU 21 is continued military use, continuing land use restrictions at this site should not be difficult. Approximately 1 to 2 weeks is required to complete site construction activities and to achieve the qualitative CAOs.

  - Safety – Because Alternative 1 does not require excavation or handling of contaminated soil, its implementation poses no significant threat to workers, off-post residential communities, or the environment. However, the placement of the asphalt cover requires the use of personal protective equipment and compliance with applicable OSHA regulations.

- Human health assessment – Installing an asphalt cover over contaminated areas and restricting future development of the site protect human health by preventing both short- and long-term exposure to contaminated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – Installation of an asphalt cover over the contaminated soil is expected to reduce the risk to all ecological receptors at SWMU 21 by 100 percent. With the cover in place, SWMU 21 presents no ecological risk in accordance with the definitions and methodology of the SWERA (Rust E&I, 1997).

- Administrative feasibility – By preventing exposure to contaminated soil, this alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101. SWMU 21 contains an operational permitted facility, and an asphalt cap will protect depot workers without affecting facility activities. The site will be reevaluated during closure of the facility.

- Cost – The estimated present worth cost of implementing Alternative 1 is $230,000. Table A-8 (see Appendix A) presents the detailed cost estimate.

6.2.2 Alternative 2 – Excavation, Solidification/Stabilization, and Land Use Restrictions

This corrective measures alternative includes excavation of the affected soil (see Figure 6-2) to a depth of 1.5 feet using an excavator, backhoe, or similar equipment. As discussed in Section 6.1, the estimated total volume of contaminated soil to be excavated is 850 yd^3. This alternative includes the collection of confirmatory soil samples from the floor and each sidewall, and analysis for antimony, beryllium, cadmium, and lead. Excavation and confirmatory sampling continue until the quantitative CAOs for these metals are achieved. Excavation will continue into existing asphalt if warranted based on confirmation samples. Asphalt removed will be sampled before disposal.

The metals contaminated soil is transported to an on-post location (agreed to by the Army and regulatory agencies), where it is solidified/stabilized and placed in a CAMU at SWMU 12/15 (Known Releases). In this process, cement or other chemicals or a proprietary binding agent is used to solidify and stabilize the homogenized soil. A cement-based process is selected for Alternative 2 because of its versatility in immobilizing metals. Pretreatment optimization, performed as part of the alternative, may indicate that another solidification/stabilization agent is more effective. TCLP is used to evaluate the effectiveness of stabilization. The stabilized soil that meets TCLP standards is then placed within the CAMU, where it is allowed to cure in place.

The objective of solidification/stabilization is to treat the contaminated soil to below applicable regulatory levels (e.g., TCLP). Pretreatment testing is required to evaluate the effectiveness of the technology and to obtain optimum design criteria. Confirmation sampling verifies that the soil is stabilized and that the regulatory levels have been met. Clean soil from an on-post borrow area is backfilled into excavated areas. The backfilled areas are graded and covered to match preexisting conditions unless otherwise directed by TEAD. The cover shall prevent surface water ponding and will minimize erosion.

Pretreatment optimization is required prior to final design of the solidification/stabilization alternative to evaluate the effectiveness of this technology on the metals-contaminated soil from the site, and to select the stabilization reagent formulation. TCLP tests are conducted to evaluate the ability of the solidification/ stabilization process to convert the contaminated soil to a nonhazardous material in accordance with RCRA. The tests are expected to produce information on the strength, durability, volume increase, and long-term integrity of the stabilized material, and on design criteria for the treatment process. For purposes of the CMS, it is assumed that Portland cement is the primary reagent to be used, and that the volume increase due to treatment of the soil is 20 percent. Five year inspections – to include sample collection and analysis – are conducted to confirm the long-term effectiveness of the solidification/ stabilization process.

Alternative 2 also includes land use restrictions to prevent future residential development at SWMU 21, as described in Section 6.2.1, and UXO survey and clearance prior to excavation activities.

Alternative 2 – excavation, solidification/stabilization, and land use restrictions – is evaluated as follows:

- <u>Technical evaluation</u>

  – <u>Performance</u> – The treatment of contaminated soil by solidification/ stabilization and the application of land use restrictions comply with UAC R315-101-3, the "Principle of Non-Degradation," by preventing the migration of antimony, beryllium, cadmium, and lead from soil to other environmental media. The qualitative CAOs developed in the CMS Work Plan (Dames & Moore, 2000) are expected to be achieved by protecting human health and the environment as a result of the immobilization of these metals in the treated soil. This alternative is applicable to both site and contaminant characteristics and is likely to meet the identified CAOs with no decrease in effectiveness over time. In addition, the land use restrictions prevent future residential development and potential exposure to lead and other contaminants in untreated soil at the site.

    This alternative requires pretreatment testing to confirm the effectiveness of solidification/stabilization for classifying the metals-contaminated soil as nonhazardous based on TCLP test results. Although solidification/ stabilization is considered to be a permanent treatment process, there is a potential for the eventual breakdown of the material and release of contained metals. The pretreatment optimization is expected to more clearly quantify this potential.

– Reliability – Solidification/stabilization and land use restrictions are expected to be effective over the long term, and have been implemented effectively at many sites. Management of waste materials is limited to contaminated soil. Pretreatment testing confirms whether solidification/stabilization can achieve the CAOs. Land use restrictions should prevent future residential exposure to contaminated soil at the site. Some degree of long-term liability may be associated with return of the stabilized soil to the CAMU at SWMU 12/15 (Known Releases). Five-year inspections are conducted to confirm the long-term effectiveness of the solidification/stabilization process.

– Implementability – Excavation equipment for this alternative is readily available; however, the number of vendors with experience in using this treatment method for contaminated soil may be limited. Because Alternative 2 requires excavation, the presence of subsurface utilities may also affect its implementation. Continuing land use restrictions should not be difficult because the specified future land use for SWMU 21 is continued military use. Approximately 1 to 2 months is likely required to complete the excavation, solidification/stabilization, and backfilling activities, and to meet the CAOs.

– Safety – This alternative poses low short-term risks to onsite workers, who may be exposed to contaminated soil during excavation and solidification/stabilization operations. However, it includes appropriate precautionary measures, as necessary (e.g., dust suppression and personal protective equipment).

- Human health assessment – Excavating and solidifying/stabilizing contaminated soil, and restricting future residential development of the site, protect human health by preventing both short- and long-term exposure to untreated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – By treating the contaminated soil and placing solidified/stabilized soil in an offsite CAMU, the risk to ecological receptors is reduced by removing contaminated soil from the site. Alternative 2 is estimated to reduce the identified risks to passerine birds, deer mice, soil fauna, and plants by 89, 47, 96, and 79 percent, respectively (see Appendix B). With these reductions, the site presents a low ecological risk to each of the above receptors – except for soil fauna, which has a low-to-moderate risk in accordance with the definitions and methodology of the SWERA (Rust E&I, 1997).

- Administrative feasibility – This alternative likely complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by treating impacted soil, thereby reducing the risk to human health. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust. Excavation of soil will disrupt ongoing facility operations. Obtaining permission to place stabilized soil at SWMU 12/15 may present administrative difficulties.

- Cost – The estimated present worth cost of implementing Alternative 2 is \$480,000. Table A-9 (see Appendix A) presents the detailed cost estimate.

6.2.3 Alternative 3 – Excavation, Soil Washing, and Land Use Restrictions

This corrective measures alternative includes excavation of the affected soil (see Figure 6-2) to a depth of 1.5 feet using an excavator, backhoe, or similar equipment. As discussed in Section 6.1, the estimated total volume of contaminated soil to be excavated is 850 yd^3. This alternative includes the collection of confirmatory soil samples from the floor and each sidewall of the excavation, and analysis for antimony, beryllium, cadmium, and lead. Excavation and confirmatory sampling continue until the quantitative CAOs for these metals are achieved. Excavation will continue into existing asphalt if warranted based on confirmation samples. Asphalt removed will be sampled before disposal.

The excavated soil is treated onsite by soil washing, which separates the contaminated soil into coarse and fine fractions. Screens are used to remove large rocks and other debris; water or proprietary solution is then added to a trommel or other size classification device, where the soil is separated into coarse- and fine-grained particles.

Most of the antimony, beryllium, cadmium, and lead present in contaminated soil is concentrated in the fines, which may be further treated using an acid leach. However, if the fines cannot be treated to cleanup objectives, the soil is sent offsite for treatment/disposal. Because the concentrations of lead (and the other contaminants) are expected to be high, it is assumed that the fines are classified as hazardous waste in accordance with applicable RCRA (i.e., TCLP test) criteria, and that they are shipped off post for disposal at a Subtitle C hazardous waste landfill. The fines are expected to require pretreatment (i.e., solidification/stabilization) at the selected TSDF facility to comply with RCRA LDRs prior to disposal in the landfill.

Large rocks, debris, and coarse-grained particles that meet applicable TCLP levels for the above contaminants are returned to the areas from which they were excavated. In addition, clean soil from an on-post borrow area is backfilled into the excavated areas, as necessary. The backfilled areas are graded and covered by a 6 inch soil or gravel cover to match preexisting conditions unless otherwise directed by TEAD. The cover shall prevent surface water ponding and will minimize erosion. If the soil washwater or proprietary solution contains excessive amounts of lead or other contaminants, it is treated onsite using ion exchange resins or another appropriate treatment method.

Pretreatment testing is required prior to final design of this alternative to evaluate the effectiveness of this technology on soil from SWMU 21 and to develop optimal process design criteria.

Alternative 3 also includes land use restrictions to prevent future residential development at SWMU 21, as described in Section 6.2.1, and UXO survey and clearance prior to excavation activities.

Alternative 3 – excavation, soil washing, and land use restrictions – is evaluated as follows:

- Technical evaluation

  - Performance – Excavation and soil washing of contaminated soil is likely to meet both the quantitative and qualitative CAOs (see Section 6.1) developed in the CMS Work Plan (Dames & Moore, 2000). This alternative complies with UAC R315-101-3, the "Principle of Non-Degradation," by treating the contaminated soil. In addition, land use restrictions prevent future residential development and potential exposure to residual contaminants in soil. Alternative 3 meets the identified CAOs with no decrease in effectiveness over time. However, the effectiveness of soil washing needs to be determined by pretreatment testing. If the percentage of fines in the contaminated soil is greater than approximately 30 percent, the effectiveness of this process may be limited.

  - Reliability – Land use restrictions and soil washing are effective over the long term, and have been implemented effectively at many sites. This corrective measures alternative eliminates Depot worker exposure to contaminated soil at the site and prevents potential future residential exposure to residual contaminants. After the washed material has been backfilled in the excavated areas, no additional management of waste materials or long-term environmental monitoring is required. However, some degree of long-term liability is associated with the placement of contaminated fine-grained soil in a landfill.

  - Implementability – Equipment for excavation and soil washing are readily available, and a Subtitle C landfill and TSDF are located within 100 miles of TEAD. Because this alternative requires excavation, the possible presence of subsurface utilities may affect its implementation. Continuing land use restrictions at this site should not be difficult because the specified future land use for SWMU 21 is continued military use. The number of vendors experienced in using this treatment technology is limited. Approximately 1 month is required to complete the excavation, soil washing, and backfilling activities, and to meet the CAOs.

- Safety – Alternative 3 poses moderate short-term risks to off-post residential communities and onsite workers. Residential communities may be exposed to contaminated soil during transportation and off-post treatment/disposal of residuals. Onsite workers may be exposed to contaminated soil during excavation, soil washing, and other soil-handling activities. However, the alternative includes appropriate precautionary measures, as necessary (e.g., dust suppression and personal protective equipment).

- Human health assessment – Excavating and washing contaminated soil, and restricting future residential development of the site, protect human health by preventing both short- and long-term exposure to contaminated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – The risk to ecological receptors at SWMU 21 is reduced by washing the contaminated soil and returning the cleaned soil to excavated areas. By decreasing the concentrations of lead and other contaminants in soil, Alternative 3 is estimated to reduce the identified risks to passerine birds, deer mice, soil fauna, and plants by 66, 44, 90, and 28 percent, respectively. With these reductions, SWMU 21 presents a low risk for the deer mice, moderate risk for passerine birds, and potentially unacceptable risks for soil fauna and plants, in accordance with the definitions and methodology of the SWERA (Rust E&I, 1997).

- Administrative feasibility – This alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by using soil washing to reduce the concentrations of metal contaminants in soil. Because the concentrations of antimony, beryllium, cadmium, and lead in soil are reduced to meet the applicable quantitative CAOs for these metals, Alternative 3 meets the human health risk criterion under UAC R315-101-6. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust. The excavated soil that is shipped off post is transported in accordance with DOT regulations. Excavation of soil will disrupt ongoing facility operations.

- Cost – The estimated present worth cost for implementing Alternative 3 is $550,000. Table A-10 (see Appendix A) presents the detailed cost estimate.

6.2.4 Alternative 4 – Excavation, Off-Post Treatment/Disposal, and Land Use Restrictions

This corrective measures alternative includes excavation of the affected soil (see Figure 6-2) to a depth of 1.5 feet using an excavator, backhoe, or similar equipment. As discussed in Section 6.1, the total volume of contaminated soil to be excavated is 850 yd^3. Alternative 4 includes the collection of confirmatory soil samples from the floor and each sidewall of the excavation, and analysis for antimony, beryllium, cadmium, and lead. Excavation and confirmatory sampling continue until the quantitative CAOs for these metals are achieved. Excavation will continue into existing asphalt if warranted based on confirmation samples. Asphalt removed will be sampled before disposal.

The excavated soil undergoes a soil profile analysis to determine if the soil exhibits a listed or characteristic RCRA hazardous waste. A preliminary review of the site contaminants and potential waste processes contributing to the contamination at SWMU 21 suggest that the metals in soil are not listed wastes. However, the contaminant data suggests that cadmium and lead will exceed TCLP regulatory levels and the soil will therefore exhibit a RCRA characteristic waste. A final waste determination will be made during the corrective action phase. A review of other regulations (e.g., State of Utah, DOT) and additional testing (e.g., TCLP) will be necessary to make this determination.

If the soil is classified as containing a hazardous waste in accordance with RCRA or other applicable criteria, it is transported to an off-post Subtitle C hazardous waste landfill for direct disposal (if contaminant concentrations meet LDR guidelines) or to a TSDF for treatment prior to disposal. For purposes of this CMS, it is assumed that the contaminated soil is sent to a TSDF for pretreatment by solidification/stabilization to comply with applicable RCRA LDRs prior to disposal in the landfill. The excavated soil is transported and manifested in compliance with applicable regulations. However, if the soil profile results are acceptable, the soil could be sent to an off-post Subtitle D landfill for disposal. Clean soil from an on-post borrow site is backfilled into the excavated areas. The backfilled areas are graded and covered to match preexisting conditions unless otherwise directed by TEAD. The cover should prevent water ponding and minimize erosion.

Alternative 4 also includes land use restrictions to prevent future residential development at SWMU 21, as described in Section 6.2.1, and UXO survey and clearance prior to excavation activities.

Alternative 4 – excavation, off-post treatment/disposal, and land use restrictions – is evaluated as follows:

- <u>Technical evaluation</u>

  – <u>Performance</u> – Excavation and off-post treatment/disposal of contaminated soil meets both the qualitative and quantitative CAOs (see Section 6.1) developed in the CMS Work Plan (Dames & Moore, 2000). This alternative also complies with UAC R315-101-3, the "Principle of Non-Degradation," by removing the contaminated soil from the site. Alternative 4 meets the identified CAOs with no decrease in effectiveness over time. In addition, land use restrictions prevent future residential development of SWMU 21 and potential exposure to residual contaminants in soil.

- Reliability – Excavation and off-post treatment/disposal, and land use restrictions, are effective over the long term and have been implemented effectively at many sites. This corrective measures alternative eliminates Depot worker exposure to contaminated soil at the site and prevents potential future residential exposure to residual contaminants. No management of waste materials or long-term environmental monitoring is required at SWMU 21. However, some degree of long-term liability is associated with the disposal of contaminated soil in an off-post landfill. Management and monitoring are required at the landfill.

- Implementability – Excavation equipment for Alternative 4 is readily available, and a Subtitle C landfill and TSDF are located within 100 miles of TEAD. Because this alternative requires excavation, the possible presence of subsurface utilities may affect its implementation. Continuing land use restrictions at this site should not be difficult, because the specified future land use for SWMU 21 is continued military use. Approximately 2 to 3 weeks is required to complete the excavation and off-post transportation/disposal activities, and to meet the CAOs.

- Safety – Alternative 4 poses moderate short-term risks to off-post residential communities and onsite workers. Residential communities may be exposed to contaminated soil during transportation and off-post treatment/disposal of the soil. Onsite workers may be exposed to contaminated soil during excavation and other soil-handling activities. However, this alternative includes appropriate precautionary measures, as necessary (e.g., dust suppression and personal protection equipment).

- Human health assessment – Excavation and off-post treatment/disposal of contaminated soil, and restriction of future residential development of the site, protect human health by preventing both short- and long-term exposure to soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – Excavation and off-post treatment/disposal of the contaminated soil reduce the risk to ecological receptors by removing the contaminated soil from the site. Alternative 4 is estimated to reduce the identified risks to passerine birds, deer mice, soil fauna, and plants by 89, 47, 96, and 79 percent, respectively. With these reductions, SWMU 21 presents a low ecological risk for passerine birds, deer mice, and plants, and low-to-moderate risk for soil fauna, in accordance with the definitions and methodology of the SWERA (Rust E&I, 1997).

- Administrative feasibility – This alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by removing the affected soil from the site. Because all soil containing antimony, beryllium, cadmium, and lead levels above the CAOs for these metals is excavated and removed from SWMU 21, Alternative 4 meets the human health risk criteria under UAC R315-101-6. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust. The excavated soil is transported in accordance with DOT regulations. Excavation of soil will disrupt ongoing facility operations.

- Cost – The estimated present worth cost of implementing Alternative 4 is $560,000. Table A-11 (see Appendix A) presents the detailed cost estimate.

6.3 COMPARATIVE ANALYSIS OF CORRECTIVE MEASURES ALTERNATIVES

Table 6-2 and the text below summarize the comparative analysis of the four corrective measures alternatives developed for the Deactivation Furnace Building (SWMU 21).

- Technical evaluation

  – Performance – Alternative 4 (excavation, off-post treatment/disposal, and land use restrictions) meets both the qualitative and quantitative CAOs and is rated high with respect to performance. Alternative 2 (excavation, solidification/stabilization, and land use restrictions) and Alternative 3 (excavation, soil washing, and land use restrictions) meet both the qualitative and quantitative CAOs, but require pretreatment testing and are rated moderate with respect to performance. Alternative 1 (asphalt cover and land use restrictions) is rated moderate for performance because it is not a permanent remedy and it meets the CAOs only if the cover is properly maintained.

  – Reliability – Alternative 4 is rated high for reliability because the technologies have been proven effective at other sites, and no O&M activities or long-term monitoring is required. Alternative 1 is rated moderate because it does not permanently remove site contamination, and it requires annual inspection and maintenance of the asphalt cover. Alternatives 2 and 3 are rated moderate because pretreatment testing is required to further evaluate their effectiveness and permanence, and 5-year site inspections are recommended to ensure the long-term effectiveness of the solidification/stabilization process.

  – Implementability – Alternatives 1 and 4 are rated high because they are easy to implement. Required equipment, materials, and contractors are readily available locally. In addition, it is estimated that Alternatives 1 and 4 could each be completed within 2 to 3 weeks. Alternatives 2 and 3 are rated moderate because there are fewer contractors experienced in performing these treatment processes. Additionally, Alternative 2

TABLE 6-2

Comparative Analysis of Corrective Measures Alternatives
Deactivation Furnace Building
(SWMU 21) (a)

Corrective Measures Alternative	**Technical Evaluation**				**Human Health Assessment**	**Environmental Assessment**	**Administrative Feasibility**	**Cost**
	Performance	**Reliability**	**Implementability**	**Safety**				
1 - Asphalt cover and land use restrictions	Moderate	Moderate	High	High	High	High	High	$230,000
2 - Excavation, solidification/ stabilization, and land use restrictions	Moderate	Moderate	Moderate	Moderate	High	High	Moderate	$480,000
3 - Excavation, soil washing, and land use restrictions	Moderate	Moderate	Moderate	Moderate	High	Moderate	Moderate	$550,000
4 - Excavation, off-post treatment/ disposal, and land use restrictions	High	High	High	Moderate	High	High	Moderate	$560,000

(a) Rankings indicate how well each alternative meets the evaluation criteria, relative to other alternatives.

requires 1 to 2 months for implementation. Alternative 3 requires approximately 1 month for implementation.

- Safety – Alternative 1 is rated high for safety because it does not require the excavation and handling of contaminated soil, and presents no significant short-term risk to off-post residential communities or on-post workers. Alternative 2 is rated moderate because – though it involves the excavation and treatment of contaminated soil – it does not include the off-post transport of hazardous materials. Alternatives 3 and 4 involve the excavation and handling of contaminated soil at the site, and the off-post shipment of either the soil or the soil-washing treatment residuals to a Class C landfill or TSDF. Each of these alternatives receives a moderate rating for safety.

- Human health assessment – Alternatives 1, 2, 3, and 4 receive a high rating for this criterion because they are protective of human health. Alternative 1 protects human health by containing the COCs beneath the asphalt cover. Alternatives 2 and 3 use soil washing or solidification/stabilization to reduce COC concentrations in the affected soil. Alternative 4 removes the contaminated soil from SWMU 21.

- Environmental assessment – Alternative 1 is rated high because the asphalt cover prevents ecological receptors from being exposed to contaminants at the site. Alternatives 2 and 4 are also rated high because the excavation and removal of contaminated soil are estimated to reduce the risks to ecological receptors to a generally low level. Alternatives 3 receives a moderate rating because soil washing is expected to reduce contaminant concentrations to a level that results in generally moderate ecological risks.

- Administrative feasibility – Alternative 1 is rated high because it meets the requirements of UAC R315-101. Alternatives 2, 3, and 4 are also expected to meet the requirements of this regulation, but are rated moderate because soil excavation will disrupt facility operations and Alternatives 2 and 3 may require a RCRA treatment permit.

- Cost – Of the four corrective measures alternatives, Alternative 1 has by far the lowest cost, estimated to be $230,000. The estimated costs of Alternatives 2, 3, and 4 are $480,000, $550,000, and $560,000, respectively.

6.4 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVE

Based on the comparative analysis presented in Section 6.3, Alternative 1 – asphalt cover and land use restrictions – is recommended as the preferred alternative for SWMU 21 because:

- It meets the qualitative CAOs, including protection of human health and the environment and compliance with the "Principle of Non-Degradation" under UAC R315-101-3.

- It has been demonstrated at other sites.

- It is reliable and easy to implement.

- It is safer to implement than the other corrective measures alternatives, because it does not require excavation and handling of contaminated soil.

- It results in negligible ecological risks.

- It can be implemented at a much lower cost than the other corrective measures alternatives.

- It should not cause unacceptable downtime in the critical operations at the Deactivation Furnace.

7.0 PESTICIDE HANDLING AND STORAGE AREA (SWMU 34)

Section 7.0 evaluates corrective measures alternatives for the Pesticide Handling and Storage Area (SWMU 34; Figure 7-1). Data from the CMS Work Plan (Dames & Moore, 2000), the human health RA (Montgomery Watson, 1997), and the SWERA (Rust E&I, 1997) are also summarized below.

7.1 SUMMARY OF RAs AND CMS WORK PLAN

Figure 7-1 shows the location and layout of the Pesticide Handling and Storage Area (SWMU 34). This site – which consists of Building 518 and a bermed concrete pad located on the south side of the building – is located in the Administration Area, in the southeastern portion of TEAD. The facility is surrounded by a locked chainlink fence. The area enclosed by the fence is approximately 75 by 75 feet (0.13 acre). Building 518 was used from 1942 until approximately 1991 for the storage of pesticides and herbicides and for the preparation of application mixtures (NUS, 1987). The bermed concrete pad was used for loading sprayer trucks with these mixtures and for rinsing containers. The pad continues to be used by a pesticides contractor at TEAD.

Pesticide containers and obsolete pesticides were disposed of at the Sanitary Landfill/Pesticide Disposal Area (SWMU 12/15; Known Releases) from approximately 1942 to 1980 (Jordan, 1989). From 1980 until 1989, pesticide wastes and containers from operational activities at SWMU 34 were disposed of at an off-post treatment and disposal facility. Drains from the building were formerly connected to an 8-inch-diameter underground pipe that discharged to the Stormwater Discharge Area (SWMU 45), located approximately 4,000 feet to the northwest. After the drains were blocked, wastewater produced by operations in the mixing sink were contained in a catch tank located on the north side of the building.

The Phase II RFI (Montgomery Watson, 1997) identified unacceptable risks and hazards to human health at SWMU 34 under the hypothetical future residential land use scenario. Therefore, according to EPA guidance and UAC R315-101-6(c)(3), this SWMU is included in the CMS process, and corrective measures must be evaluated. However, the human health RA concluded that SWMU 34 presents no unacceptable risk to current Depot workers or future construction workers. In addition, because the assumed future land use is continued military use, there is no unacceptable risk under the realistic future land use scenario. Although the hypothetical future residential land use scenario presents unacceptable risks and hazards, the realistic future land use scenario presents no unacceptable risks; therefore, management measures are evaluated according to UAC R315-101-1(b)(4).

No groundwater monitoring was conducted at SWMU 34. However, according to the Phase II RFI (Montgomery Watson, 1997), the site constituents are not expected to affect groundwater based on the general decrease in contaminant concentrations with depth, tendency of the contaminants to strongly adsorb to soil, low precipitation rates, high evaporation rates, and depth to groundwater (which is estimated to be 375 feet bgs).

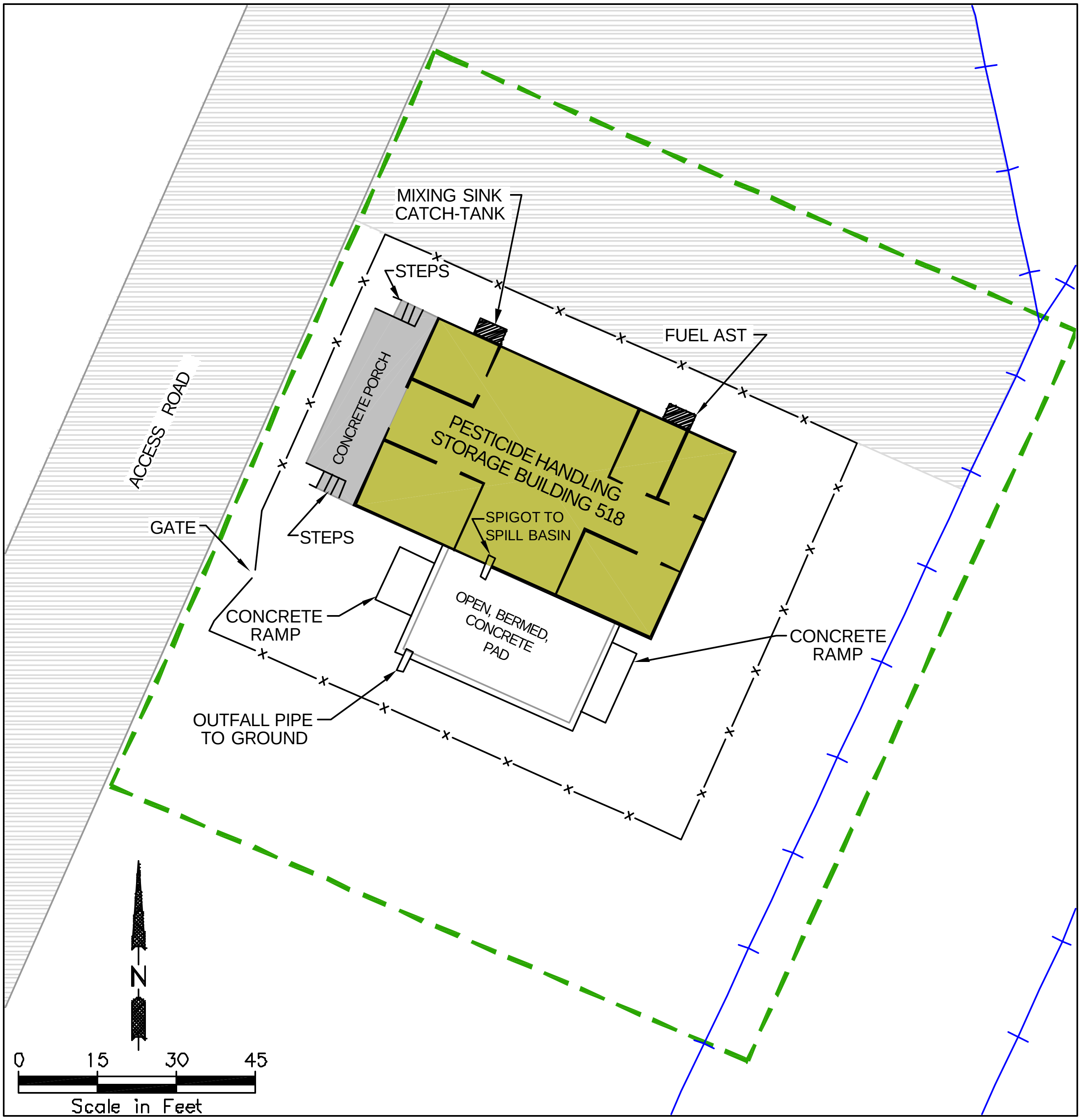
The SWERA (Rust E&I, 1997) indicated that the contaminants detected in soil at SWMU 34 are unlikely to pose excessive or unacceptable ecological risk to TEAD receptors and recommended no corrective measures to reduce ecological risk.

The CMS Work Plan (Dames & Moore, 2000) identified COCs by comparing the maximum concentration of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) to the respective quantitative CAO. Based on this evaluation, arsenic, chlordane, dichloro-diphenyl-dichloroethylene (DDE), dichloro-diphenyl-trichloroethane (DDT), and heptachlor were determined to be COCs for surface soil. No COCs were identified for subsurface soil. The following table shows the maximum concentrations of the identified COCs in surface soil compared to the CAOs:

Pesticide Handling and Storage Area (SWMU 34)			
COC	**Maximum Concentrations (µg/g)**	**EPC (µg/g)**	**CAO (µg/g)**
Arsenic	42	16	32
Chlordane	96	17.2	6.6
DDE	24	4.5	8.3
DDT	160	27	8.3
Heptachlor	21	3.43	0.64

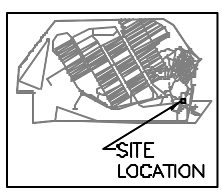
The COCs identified in surface soil were evaluated in conjunction with the results of the human health RA to determine whether active corrective measures need to be evaluated. As stated in the Phase II RFI (Montgomery Watson, 1997), the human health RA used the EPC, which represents the likely concentration that an individual would be exposed to by working in the area of the SWMU, to calculate human health risks. The EPC for each COC was compared to the respective CAO, as shown above.

Based on this comparison, which is described in detail in the CMS Work Plan (Dames & Moore, 2000), the human health risks associated with arsenic and DDE under the realistic future land use scenario were concluded to be insignificant. The EPCs for chlordane and DDT are approximately three times as high as their corresponding CAOs. The EPC for heptachlor is approximately five times as high as its CAO. As described in Appendix A of the CMS Work Plan, because a concentration equal to the CAO results in a cancer risk of 1×10^{-6}, the COCs do not result in unacceptable risk levels. This conclusion is confirmed by results of the human health RA (Montgomery Watson, 1997). Nevertheless, because of the presence of three "hot spots" (corresponding to surface soil samples SS34001, SS34005, and SS34011) – where the concentrations of chlordane, DDT, and heptachlor exceed their CAOs by more than one order of magnitude – the CMS Work Plan identified active corrective measures (i.e., treatment technologies) as well as management measures to address pesticides in surface soil.



LEGEND

- RAILROAD
- FENCE
- BUILDING
- PAVED AREA
- SWMU BOUNDARY (APPROX.)



Source: Modified from USGS Grantsville 7.5 minute quadrangle. Montgomery Watson, 1995.

FIGURE 7-1
PESTICIDE HANDLING AND STORAGE AREA
(SWMU 34)
TOOELE ARMY DEPOT

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Treatment technologies are not considered to be necessary for arsenic because its maximum concentration only slightly exceeds its CAO, and its presence is likely due to the naturally occurring background variation of metals in soil at TEAD. In addition, the EPC for arsenic is well below its CAO. Treatment technologies are not considered necessary for DDE because only one sample exceeded the CAO level and the EPC for DDE is well below its CAO.

The extent of contamination at SWMU 34 was estimated in the CMS Work Plan (Dames & Moore, 2000) and is shown on Figure 7-2, together with the COC locations that helped define the area and volume of contaminated soil. The estimated total area and volume of contaminated soil to be evaluated for possible active corrective measures are 830 ft^2 and 31 yd^3, respectively. The depth of contamination is assumed to be 1 foot bgs. Approximately 350 ft^2 of the area and 13 yd^3 of the volume are due to the COC location at SS34011, which is covered with asphalt.

In addition to the above quantitative CAOs, the CMS Work Plan (Dames & Moore, 2000) presented qualitative CAOs for SWMU 34 to comply with UAC R315-101, as follows:

- To protect other media from further degradation (i.e., to ensure that levels of contamination do not increase beyond existing levels, per UAC R315-101-3).

- To protect human health and the environment in accordance with Federal, State, and local regulatory requirements.

- To ensure that – if the current military land use scenario changes in the future to residential or other use – appropriate measures are taken to adequately protect human health and the environment.

The CMS Work Plan (Dames & Moore, 2000) identified three alternatives to address chlordane, DDT, and heptachlor in surface soil at the Pesticide Handling and Storage Area, as follows:

SWMU 34	Corrective Measures Alternative
PESTICIDE HANDLING AND STORAGE AREA	**Land use restrictions** Impose land use restrictions to prevent residential development **Soil cover, fence, and land use restrictions** Install a soil cover over impacted area Periodically inspect and maintain cover and existing fence Impose land use restrictions to prevent residential development **Excavation, off-post treatment/disposal, and land use restrictions** Excavate contaminated soil Fill and compact with clean soil Characterize, transport, and treat/dispose of chlordane-, DDT-, and heptachlor-contaminated soil off post in accordance with U.S. Army protocol and State and Federal regulations Impose land use restrictions to prevent residential development

Table 7-1 summarizes the risks to human health and the environment evaluated in the Phase II RFI (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997), and the corrective measures alternatives identified for SWMU 34 in the CMS Work Plan (Dames & Moore, 2000).

7.2 DETAILED EVALUATION OF CORRECTIVE MEASURES ALTERNATIVES

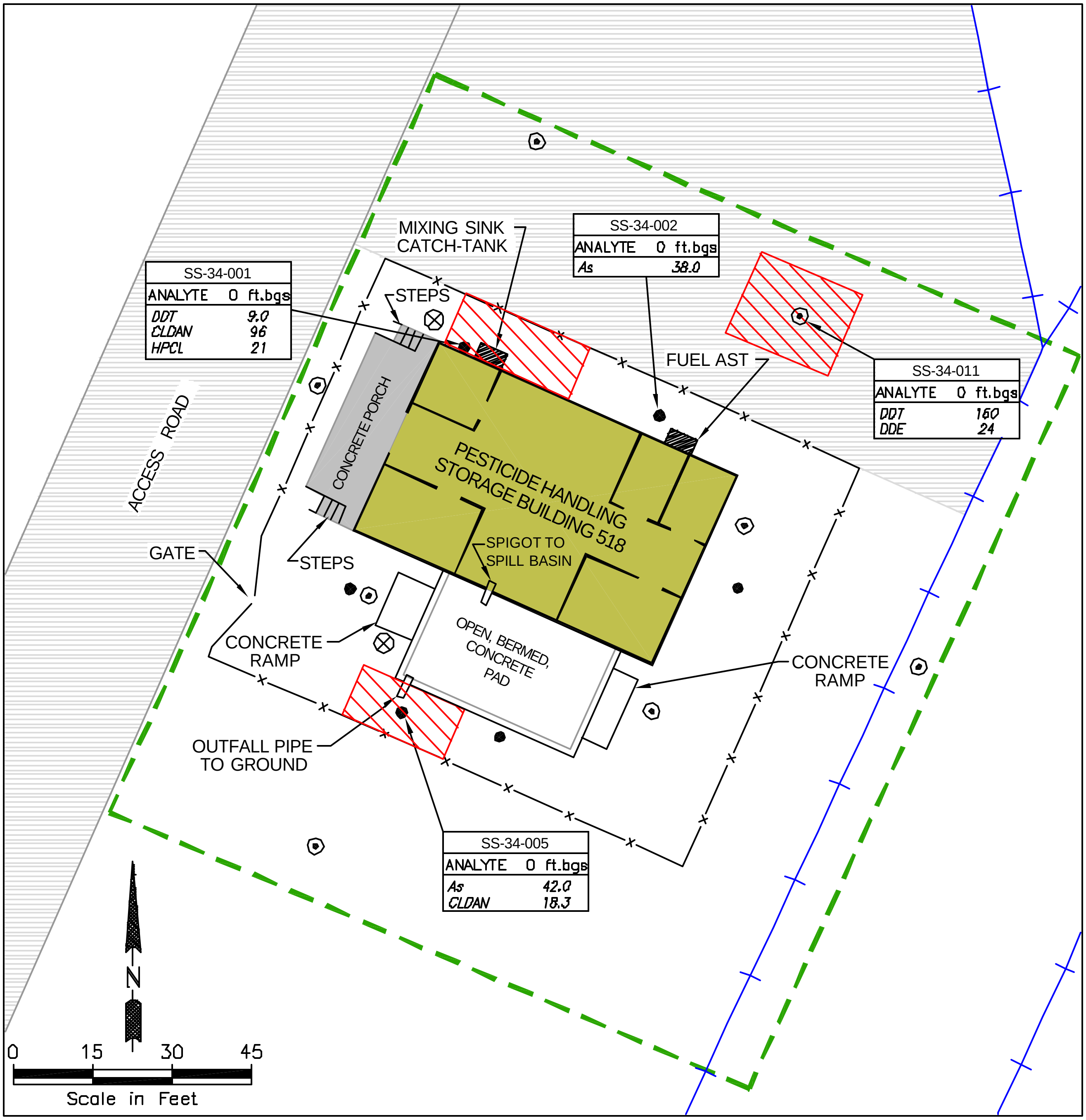
Section 7.2 evaluates the three corrective measures alternatives for the Pesticide Handling and Storage Area (SWMU 34). Each of the alternatives includes land use restrictions, which are described in detail in Section 7.2.1.

7.2.1 Alternative 1 – Land Use Restrictions

This corrective measures alternative involves the application of land use restrictions to ensure that the current land use (i.e., military) does not change to residential or other unauthorized use in the future. No active corrective measures are included in Alternative 1.

These restrictions would be incorporated into TEAD's master land use plan. This plan also calls for inspections and monitoring to ensure the restrictions are being observed. Because U.S. Army regulations direct that all revisions to this plan be evaluated with regard to potential impacts to human health and the environment, authorization for another (i.e., nonmilitary) use of SWMU 34 requires the resolution of conflicts between identified risks and hazards and proposed changes in land use at the site.

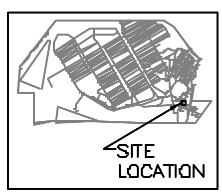
The real property planning board has authority over land use at the base, and is responsible for developing, enforcing, and modifying the installation's master land use plan. The authority of the board is derived from the responsible major Army command (i.e., OSC), which has specific oversight functions. These responsibilities include



LEGEND

- 3-FOOT BORING
- 20-FOOT BORING
- SURFACE SOIL SAMPLE
- ESTIMATED AREA OF CONTAMINATION
- RAILROAD
- FENCE
- BUILDING
- PAVED AREA
- SWMU BOUNDARY (APPROX.)

CONCENTRATIONS IN ug/g



Source: Modified from USGS Grantsville 7.5 minute quadrangle. Montgomery Watson, 1995.

FIGURE 7-2
COC LOCATIONS AND APPROXIMATE AREA
OF CONTAMINATION
PESTICIDE HANDLING AND STORAGE AREA
(SWMU 34)
TOOELE ARMY DEPOT

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TABLE 7-1

Summary of Phase II RFI, SWERA, and CMS Work Plan
Pesticide Handling and Storage Area (SWMU 34)

<table>
<tr><th colspan="9">Phase II RFI (Montgomery Watson, 1997)</th><th>SWERA (Rust E&I, 1997)</th><th colspan="2">CMS Work Plan (Dames & Moore, 2000)</th></tr>
<tr><th colspan="8">Human Health Risk Assessment (a)</th><th>Impacts to Groundwater</th><th>Ecological Risk</th><th>COCs (b)</th><th>Corrective Measures Alternative (c)</th></tr>
<tr><th colspan="4">Hypothetical Future Residential Land Use Scenario (d)</th><th colspan="4">Realistic Future Land Use Scenario (e)</th><td rowspan="4">None</td><td rowspan="4">Low</td><td rowspan="4">Surface soil:
Arsenic
Chlordane
DDE
DDT
Heptachlor</td><td rowspan="4">Land use restrictions
Soil cover, fence, and land use restrictions
Excavation, off-post treatment/ disposal, and land use restrictions</td></tr>
<tr><th></th><th>Risk</th><th>HI</th><th>Blood Lead Level (f)</th><th></th><th>Risk</th><th>HI</th><th>Blood Lead Level (f)</th></tr>
<tr><td>Adult</td><td>4×10^{-4}</td><td>NE (g)</td><td>NE</td><td>Military</td><td>1×10^{-5}</td><td>0.2</td><td>3.7</td></tr>
<tr><td>Child</td><td>NE</td><td>10</td><td>7.5</td><td>Construction</td><td>1×10^{-6}</td><td>0.2</td><td>3.6</td></tr>
</table>

(a) Risks, HIs, and blood lead levels that are above comparison levels appear in bold type.
(b) Arsenic and DDE result in negligible risk to human health. The corrective measures evaluated in the CMS Report focus on chlordane, DDT, and heptachlor only.
(c) The selected corrective measures alternative appears in bold italic type.
(d) EPA guidance and UAC R315-101-5.2(b)(1) require evaluation of the hypothetical future land use scenario. Because risks and HIs are greater than 1×10^{-6} and 1.0, respectively, EPA guidance and UAC R315-101-6(c)(3) indicate that a CMS must be performed.
(e) EPA guidance and UAC R315-101-5.2(b)(2) require evaluation of the realistic future land use scenario. Because risks and HIs are less than 1×10^{-4} and 1.0, respectively, UAC R315-101-6(d) indicates that management measures and active corrective measures can be evaluated.
(f) Blood lead levels are expressed as micrograms per deciliter (μg/dL) for 95 percent of the population (should not exceed 10 μg/dL).
(g) NE = pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).

approving the installation's master land use plan and any proposed changes. Appendix C of the CMS Work Plan (Dames & Moore, 2000) presents a more detailed description of land use restrictions.

Alternative 1 – land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – Land use restrictions prevent future residential exposure to contaminants in soil. This corrective measures alternative is applicable to both site and contaminant characteristics, and maintains its effectiveness over time. However, the CAOs developed in the CMS Work Plan (Dames & Moore, 2000) are only achieved if a 10^{-4} risk level for CAOs is considered acceptable for the exposure of Depot workers to pesticides in soil.

  – Reliability – Land use restrictions are effective over the long term and have been implemented at many sites with positive results. However, they are not a permanent remedy for site contamination. No residential or other unauthorized exposure should occur while the restrictions are in place. No O&M, management of waste materials, or long-term environmental monitoring is required.

  – Implementability – Because SWMU 34 is currently under military use, continuing land use restrictions at this site should not be difficult.

  – Safety – No intrusive activities are required for implementation of Alternative 1.

- Human health assessment – Restricting future residential development of the site prevents residential exposure to the previously identified contaminants in soil at SWMU 34. However, Depot workers are still exposed to elevated pesticide concentrations. The residual risk remaining onsite for soil results from soil contamination at concentrations above military use CAOs, which are the realistic land use CAOs.

- Environmental assessment – This alternative does not reduce ecological risk but the SWERA (Rust E&I, 1997) indicated that the contaminants in soil are unlikely to pose excessive or unacceptable ecological risk.

- Administrative feasibility – Because SWMU 34 is to remain under U.S. Army control, land use restrictions will be administered through the installation's real property planning board. This alternative meets the specified requirements of UAC R315-101 by preventing future residential development at this site.

- Cost – The estimated cost of implementing this corrective measures alternative is $12,000. Table A-12 (see Appendix A) presents the detailed cost estimate.

7.2.2 Alternative 2 – Soil Cover, Fence, and Land Use Restrictions

This corrective measures alternative includes placement of a 1-foot-thick soil cover over the affected area at SWMU 34 (Figure 7-2). As discussed in Section 7.1, the estimated area of contamination is 830 ft^2; however, 350 ft^2 around SS34011 is already covered with asphalt. Therefore, the total area that needs to be covered is 480 ft^2. The soil cover is constructed using clean soil from an on-post borrow area and is placed in engineered, compacted lifts. The cover is graded for positive drainage at a minimum slope of 2 percent over the limit of contamination; it is covered with gravel to minimize erosion of the cap. The cap is installed and maintained to prevent contaminant migration due to drainage culverts. Building 518 and the soil cover areas are already surrounded by a chainlink fence with a top rail and barbed wire.

Annual inspections are performed to verify that the asphalt at SS34011, soil cover, and fence have not been damaged. Maintenance is performed as required. In addition, this alternative applies land use restrictions to prevent future residential development at SWMU 34, as described in Section 7.2.1. The land use restrictions will state that contamination removal must be evaluated if the property changes ownership or is used for any purpose that could disturb the cover.

Alternative 2 – soil cover, fence, and land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – The installation of a soil cover and the application of land use restrictions comply with UAC R315-101-3, the "Principle of Non-Degradation," by preventing the migration of pesticides from soil to other environmental media. Although the cover is not a permanent remedy and the soil containing concentrations above the quantitative CAO for DDT is left in place, Alternative 2 achieves the qualitative CAOs developed in the CMS Work Plan (Dames & Moore, 2000) by preventing human exposure to the contaminated soil. This alternative is applicable to both site and contaminant characteristics; as long as the soil cover and fence are properly maintained, it meets the identified CAOs with no decrease in effectiveness over time.

  – Reliability – Maintenance and annual inspection of the soil cover and fence are required to ensure the long-term effectiveness of Alternative 2. No Depot worker exposure to the identified contamination will occur while the soil cover and fence are in place. Although land use restrictions are effective over the long term and have been implemented at many sites with positive results, they are not a permanent remedy for site contamination. This alternative does not require the management of waste materials or long-term environmental monitoring. Some degree of long-term liability is associated with the contaminated soil covered but still remaining onsite.

– Implementability – Equipment and materials required for installation/maintenance of the soil cover and fence are readily available. Because the specified future land use for SWMU 34 is continued military use, continuing land use restrictions at this site should not be difficult. Approximately 2 weeks is required to complete site construction activities and to achieve the qualitative CAOs.

– Safety – Because this alternative does not require excavation or handling of contaminated soil, its implementation poses no significant threat to workers, off-post residential communities, or the environment. However, placement of the soil cover requires the use of personal protective equipment and compliance with applicable OSHA regulations.

- Human health assessment – The COCs previously identified at SWMU 34 do not pose an unacceptable risk to human health. Installing a soil cover over the contaminated area and maintaining a fence, along with restricting future development of the site, further protect human health by preventing both short- and long-term exposure to contaminated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – The SWERA (Rust E&I, 1997) indicated that SWMU 34 does not present an excessive or unacceptable risk to ecological receptors. The installation/maintenance of a soil cover and fence further minimizes ecological impacts to the environment.

- Administrative feasibility – By preventing exposure to contaminated soil, this alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101.

- Cost – The estimated present worth cost of implementing Alternative 2 is \$43,000. Table A-13 (see Appendix A) presents the detailed cost estimate.

7.2.3 Alternative 3 – Excavation, Off-Post Treatment/Disposal, and Land Use Restrictions

This corrective measures alternative includes excavation of the contaminated soil (see Figure 7-2) to a depth of 1 foot using an excavator, backhoe, or similar equipment. As discussed in Section 7.1, the estimated total volume of contaminated soil to be excavated is 31 yd^3. The asphalt pavement at SS-34-011 will have to be removed to excavate that hot spot. The asphalt pavement along the SS-34-001 hot spot may also require removal as determined by the confirmation sampling. Asphalt removed will be sampled before disposal. Alternative 3 includes the collection of confirmatory soil samples from the floor and each sidewall of the excavation, and analysis for chlordane, DDT, and heptachlor. Excavation and confirmatory sampling continue until the quantitative CAOs for these pesticides are achieved.

The excavated soil undergoes a soil profile analysis to determine if the soil exhibits a listed or characteristic RCRA hazardous waste. A preliminary review of the site contaminants and potential waste processes contributing to the contamination at SWMU 34 suggest that the pesticides in soil may be qualified as listed wastes. The contaminant data also suggests that chlordane may exceed TCLP regulatory levels and the soil will therefore exhibit a RCRA characteristic waste. A final waste determination will be made during the corrective action phase. A review of other regulations (e.g., State of Utah, DOT) and additional testing (e.g., TCLP) will be necessary to make this determination.

If the excavated soil is classified as containing a hazardous waste in accordance with RCRA or other applicable criteria, it is transported to an off-post Subtitle C hazardous waste landfill for direct disposal (if concentrations meet LDR guidelines) or to a TSDF for treatment prior to disposal. For purposes of this CMS, it is assumed that the excavated soil is sent to a TSDF for pretreatment by incineration to comply with applicable RCRA LDRs prior to disposal in the landfill. The excavated soil is transported and manifested in compliance with applicable regulations. Clean soil from an on-post borrow site is backfilled into the excavated areas. The backfilled areas are graded and covered to match preexisting conditions unless otherwise directed by TEAD. The cover should prevent water ponding and minimize erosion.

Alternative 3 also includes land use restrictions to prevent future residential development at SWMU 34, as described in Section 7.2.1.

Alternative 3 – excavation, off-post treatment/disposal, and land use restrictions – is evaluated as follows:

- <u>Technical evaluation</u>

  – <u>Performance</u> – Excavation and off-post treatment/disposal of contaminated soil meet both the qualitative and quantitative CAOs (see Section 7.1) developed in the CMS Work Plan (Dames & Moore, 2000). This alternative also complies with UAC R315-101-3, the "Principle of Non-Degradation," by removing the contaminated soil from the site. Alternative 3 meets the identified CAOs with no decrease in effectiveness over time. In addition, land use restrictions prevent future residential development of SWMU 34 and potential exposure to residual contaminants in soil.

- Reliability – Excavation and off-post treatment/disposal, and land use restrictions, are effective over the long term and have been implemented effectively at many sites. This corrective measures alternative eliminates Depot worker exposure to contaminated soil at the site and prevents potential future residential exposure to residual contaminants. No management of waste materials or long-term environmental monitoring is required at SWMU 34. Some degree of long-term liability is associated with the placement of contaminated soil in a landfill. Management and monitoring are required at the landfill.

- Implementability – Excavation equipment for this alternative is readily available, and a Subtitle C landfill and TSDF are located within 100 miles of TEAD. Because Alternative 3 requires excavation, the possible presence of subsurface utilities may affect its implementation. Continuing land use restrictions at this site should not be difficult because the specified future land use for SWMU 34 is continued military use. Approximately 1 to 2 weeks is required to complete the excavation, off-post transportation/disposal, and backfilling, and to meet the CAOs.

- Safety – Alternative 3 poses a low short-term risk to off-post residential communities and onsite workers. Residential communities may be exposed to contaminated soil during transportation and off-post treatment/disposal of the soil. Onsite workers may be exposed to contaminated soil during excavation and other soil-handling activities. However, the volume of contaminated soil is estimated to be small (31 yd^3), and this alternative includes appropriate precautionary measures, as necessary (e.g., dust suppression and personal protection equipment).

- Human health assessment – Excavation and off-post treatment/disposal of contaminated soil, and restriction of future residential development of the site, further protect human health by preventing both short- and long-term exposure to contaminated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – The SWERA (Rust E&I, 1997) indicated that SWMU 34 does not present an excessive or unacceptable risk to ecological receptors. Excavation and off-post treatment/disposal of contaminated soil will mitigate risks to ecological receptors by removing COCs from the site.

- Administrative feasibility – This alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by removing the contaminated soil from the site. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust. The excavated soil is transported in accordance with DOT regulations.

- Cost – The estimated present worth cost of implementing Alternative 3 is $63,000. Table A-14 (see Appendix A) presents the detailed cost estimate.

7.3 COMPARATIVE ANALYSIS OF CORRECTIVE MEASURES ALTERNATIVES

Table 7-2 and the text below summarize the comparative analysis of the three corrective measures alternatives developed for the Pesticide Handling and Storage Area (SWMU 34).

- Technical evaluation

  – Performance – Alternative 3 (excavation, off-post treatment/disposal, and land use restrictions) meets the qualitative and quantitative CAOs, and is rated high with respect to performance. Alternative 2 (soil cover, fence, and land use restrictions) is rated moderate because it is not a permanent remedy and it only meets the CAOs if the cover is properly maintained. Alternative 1 (land use restrictions) is rated moderate for performance because it only meets the quantitative CAOs for SWMU 34 if a 10^{-4} risk level is considered acceptable.

  – Reliability – Alternative 3 is rated high for reliability because it has been proven effective at other sites and requires no O&M activities or long-term monitoring. Alternative 2 is rated moderate because it does not permanently remove site contamination, and it requires annual inspection and maintenance of the soil cover and fence. Alternative 1 is rated moderate because it has been proven effective at other sites to prevent residential use; however, it does not permanently remove site contamination, and it does not address Depot personnel exposure to contaminated soil.

  – Implementability – Alternatives 1, 2, and 3 are all rated high because they are easy to implement. Equipment, materials, and contractors required to implement Alternatives 2 and 3 are readily available locally. In addition, it is estimated that Alternatives 2 and 3 could be completed within 2 weeks.

  – Safety – Alternatives 1 and 2 are rated high for safety because they do not require the excavation and handling of contaminated soil, and present an insignificant short-term risk to off-post residential communities or on-post workers. Alternative 3 is rated moderate because – though it involves the excavation and handling of contaminated soil, and the off-post shipment of soil to a Class C landfill or TSDF – the amount of contaminated soil in question is very small.

TABLE 7-2

Comparative Analysis of Corrective Measures Alternatives
Pesticide Handling and Storage Area (SWMU 34) (a)

Corrective Measures Alternative	Technical Evaluation				Human Health Assessment	Environmental Assessment	Administrative Feasibility	Cost
	Performance	Reliability	Implementability	Safety				
1 - Land use restrictions	Moderate	Moderate	High	High	Moderate	Moderate	Moderate	$12,000
2 - Soil cover, fence, and land use restrictions	Moderate	Moderate	High	High	High	High	High	$43,000
3 - Excavation, off-post treatment/ disposal, and land use restrictions	High	High	High	Moderate	High	High	High	$63,000

(a) Rankings indicate how well each alternative meets the evaluation criteria, relative to other alternatives.

- Human health assessment – Alternative 1 receives a moderate rating, while Alternatives 2 and 3 receive a high rating for this criterion because they are protective of human health. Alternative 1 prevents residential exposure by restricting future residential development of the site; however, Depot workers are still exposed to elevated pesticide concentrations. Alternative 2 protects human health by containing the COCs beneath the soil cover. Alternative 3 protects human health by removing the contaminated soil from the Depot.

- Environmental assessment – Alternatives 2 and 3 each receive a high rating for this criterion because they reduce risk to ecological receptors. Alternative 1 is rated moderate because although it does not reduce ecological risk through removal, the SWERA concluded that the ecological risk at SWMU 34 does not warrant corrective measures.

- Administrative feasibility – Alternatives 2 and 3 are rated high because they are expected to meet the requirements of UAC R315-101-3. Alternative 1 is rated moderate because pesticides above depot worker CAO levels remain in soil.

- Cost – The estimated cost of Alternative 1 is $12,000. Of the two active corrective measures alternatives, Alternative 2 has the lower cost, estimated to be $43,000. The estimated cost of Alternative 3 is $63,000.

7.4 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVE

Based on the comparative analysis presented in Section 7.3, Alternative 3 – excavation, off-post treatment/disposal, and land use restrictions – is recommended as the preferred alternative for SWMU 34 because:

- It meets the quantitative and qualitative CAOs, including protection of human health and the environment and compliance with the "Principle of Non-Degradation" under UAC R315-101-3.

- It has been demonstrated at other sites.

- It is reliable and easy to implement.

- It does not require long term O&M.

- Although Alternative 3 is more expensive than Alternative 2, the long-term O&M requirements (which are more difficult to estimate) of Alternative 2 may make the two alternatives similar in cost.

8.0 CONTAMINATED WASTE PROCESSING PLANT (SWMU 37)

Section 8.0 evaluates corrective measures alternatives for the Contaminated Waste Processing Plant (SWMU 37; Figure 8-1). Data from the CMS Work Plan (Dames & Moore, 2000), the human health RA (Montgomery Watson, 1997), and the SWERA (Rust E&I, 1997) are also summarized below.

8.1 SUMMARY OF RAs AND CMS WORK PLAN

Figure 8-1 shows the location and layout of the Contaminated Waste Processing Plant (SWMU 37), which is located in the southwestern portion of TEAD. This site includes one large building (Building 1325A), a smaller storage building (Building 1325B), and paved staging and storage areas. A 4-foot-high barbed wire fence surrounds the facility, which occupies an area of approximately 150 by 125 feet.

From approximately 1980 until it was closed in 1990, the contaminated waste processor (CWP) was used for flashing scrap metal and incinerating pentachlorophenol (PCP)-treated wooden crates, general packaging materials, scrap resins, and fabric contaminated with explosives. It was not used for deactivating munitions. Metal debris from these operations was certified as clean and sent to the Defense Reutilization and Marketing Office (DRMO) Storage Yard (SWMU 26; Group B SWMUs) for salvage. Air pollution control equipment (including dust and ash collection equipment) was installed during construction of the furnace. A washwater collection system (including sump) and a storm drain system and culvert were located north of Building 1325A.

The Phase II RFI (Montgomery Watson, 1997) identified unacceptable risks and hazards to human health at SWMU 37 under the hypothetical future residential land use scenario. Therefore, according to EPA guidance and UAC R315-101-6(c)(3), this SWMU is included in the CMS process, and corrective measures must be evaluated. However, the human health RA concluded that SWMU 37 presents no unacceptable risk to current Depot workers or future construction workers. In addition, because the assumed future land use is continued military use, there is no unacceptable risk under the realistic future land use scenario. Although the hypothetical future residential land use scenario presents unacceptable risks, the realistic future land use scenario presents no unacceptable risks; therefore, management measures are evaluated according to UAC R315-101-1(b)(4).

No groundwater monitoring was conducted at SWMU 37. However, according to the Phase II RFI (Montgomery Watson, 1997), the site constituents are not expected to affect groundwater based on the relatively low levels of contamination detected in soil, low precipitation rates, high evaporation rates, and depth to groundwater (which is estimated to be approximately 450 feet bgs).

The SWERA (Rust E&I, 1997) indicated that the contaminants detected in soil at SWMU 37 pose a moderate ecological risk. The SWERA further stated that these contaminants are unlikely to present excessive or unacceptable ecological risk to TEAD receptors, and recommended no corrective measures to reduce the ecological risk.

The CMS Work Plan (Dames & Moore, 2000) identified COCs by comparing the maximum concentration of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) to the respective quantitative CAO. Based on this evaluation, benzo(a)anthracene, benzo(a)pyrene and dioxins/furans were determined to be COCs for surface soil. No COCs were identified for subsurface soil.

The COCs identified in surface soil were evaluated in conjunction with the results of the human health RA to determine whether active corrective measures need to be evaluated. As stated in the Phase II RFI (Montgomery Watson, 1997), the human health RA used the EPC, which represents the likely concentration that an individual would be exposed to by working in the area of the SWMU, to calculate human health risks. The EPC for each COC was compared to the respective CAO.

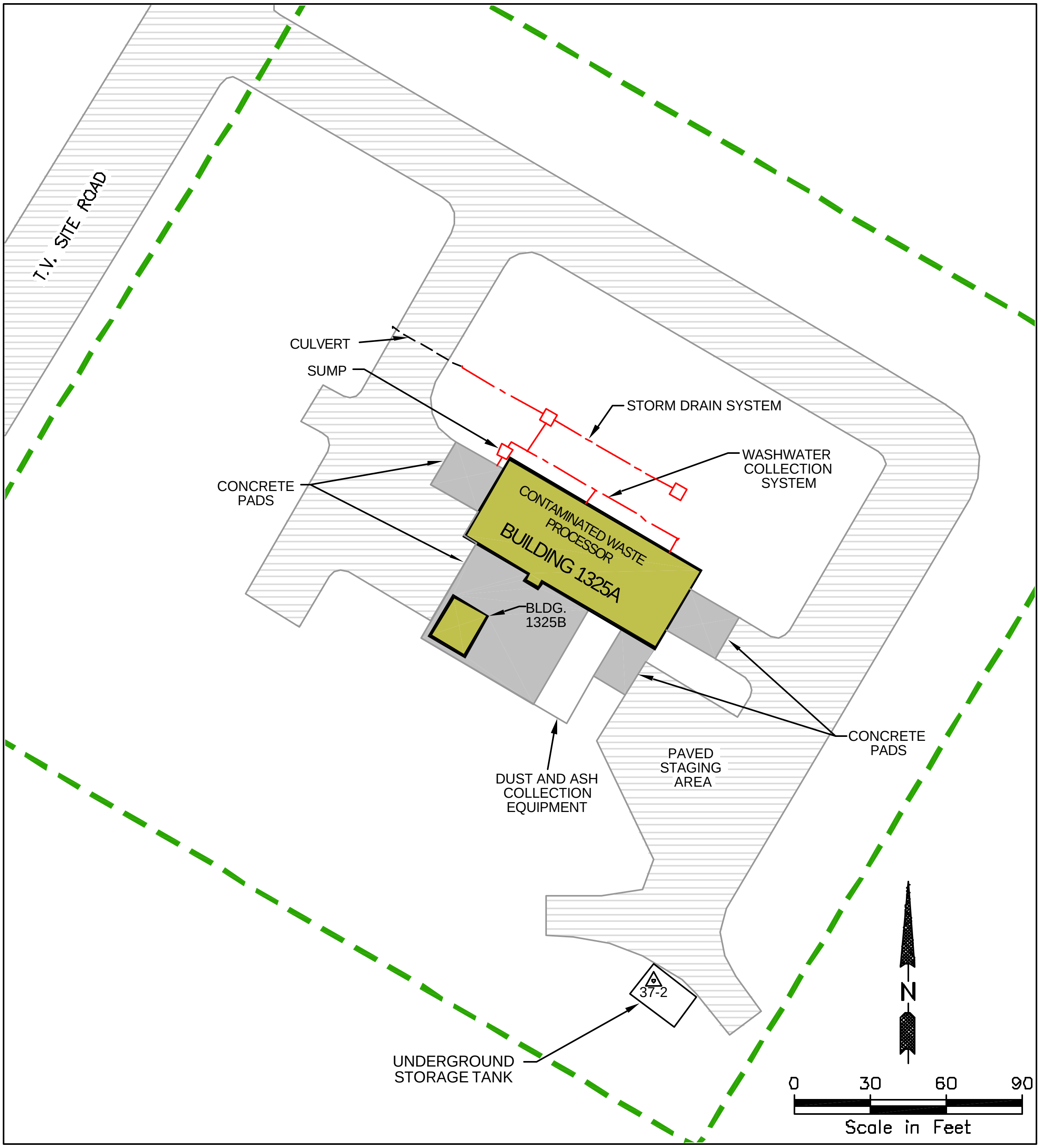
Based on this comparison, which is described in detail in the CMS Work Plan (Dames & Moore, 2000), the EPC for dioxins/furans slightly exceeds the corresponding CAO. The conservatively calculated EPC for benzo(a)anthracene is less than its CAO; the conservatively calculated EPC for benzo(a)pyrene is approximately four times as high as its CAO. Because the CAO concentrations correspond to a cancer risk of 1×10^{-6}, the EPC concentrations for dioxins/furans, benzo(a)anthracene, and benzo(a)pyrene do not result in an unacceptable risk at SWMU 37. To restate, even the maximum concentrations of benzo(a)anthracene, benzo(a)pyrene, and dioxins/furans are less than one-sixth of their CAOs if a 10^{-4} risk level is considered acceptable. Therefore, the CMS Work Plan identified management measures to address the contaminants detected in surface soil; no active corrective measures were identified for SWMU 37.

In summary – though the CMS Work Plan (Dames & Moore, 2000) identified three COCs for surface soil at SWMU 37 – the COCs are isolated occurrences, and the associated human health and environmental risks were determined to be acceptable. The CAO for SWMU 37 is to ensure that – if the future land use changes – appropriate measures are taken to adequately protect human health and the environment.

Based on the evaluation of risks and hazards to human health and the environment, and regulatory requirements, only management measures are evaluated for the Contaminated Waste Processing Plant. The CMS Work Plan (Dames & Moore, 2000) identified the following corrective measures alternative for SWMU 37:

SWMU 37	Corrective Measures Alternative
CONTAMINATED WASTE PROCESSING PLANT	**Land use restrictions** Impose land use restrictions to prevent residential development

Table 8-1 summarizes the risks to human health and the environment evaluated in the Phase II RFI (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997), and



LEGEND

- PAVED AREA
- SURVEYED REFERENCE POINT
- SUBSURFACE PIPING
- BUILDING
- SWMU BOUNDARY (APPROX.)

Source: Modified from USGS Grantsville 7.5 minute quadrangle. Montgomery Watson, 1995.

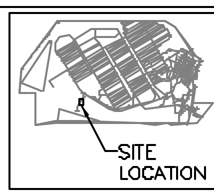


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FIGURE 8-1
CONTAMINATED WASTE PROCESSING PLANT
(SWMU 37)
TOOELE ARMY DEPOT

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TABLE 8-1

Summary of Phase II RFI, SWERA, and CMS Work Plan
Contaminated Waste Processing Plant (SWMU 37)

Phase II RFI (Montgomery Watson, 1997)									SWERA (Rust E&I, 1997)	CMS Work Plan (Dames & Moore, 2000)	
Human Health Risk Assessment (a)								**Impacts to Groundwater**	**Ecological Risk**	**COCs (b)**	**Corrective Measures Alternative (c)**
Hypothetical Future Residential Land Use Scenario (d)				**Realistic Future Land Use Scenario (e)**				None	Moderate	Surface soil: Benzo(a)anthracene Benzo(a)pyrene Dioxins/furans	***Land use restrictions***
	Risk	**HI**	**Blood Lead Level**		**Risk**	**HI**	**Blood Lead Level**				
Adult	**6×10^{-4}**	NE (f)	NE	Military	1×10^{-5}	0.002	NE				
Child	NE	**60**	NE	Construction	6×10^{-7}	0.006	NE				

(a) Risks, HIs, and blood lead levels that are above comparison levels appear in bold type.

(b) Benzo(a)anthracene, benzo(a)pyrene, and dioxins/furans were detected above their CAOs at one, two, and three locations, respectively.

(c) The selected corrective measures alternative appears in bold italic type.

(d) EPA guidance and UAC R315-101-5.2(b)(1) require evaluation of the hypothetical future land use scenario. Because risks and HIs are greater than 1×10^{-6} and 1.0, respectively, EPA guidance and UAC R315-101-6(c)(3) indicate that a CMS must be performed.

(e) EPA guidance and UAC R315-101-5.2(b)(2) require evaluation of the realistic future land use scenario. Because risks and HIs are less than 1×10^{-4} and 1.0, respectively, UAC R315-101-6(d) indicates that management measures and active corrective measures can be evaluated.

(f) NE = pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).

the corrective measures alternative identified for SWMU 37 in the CMS Work Plan (Dames & Moore, 2000).

8.2 DETAILED EVALUATION OF CORRECTIVE MEASURES ALTERNATIVE

This corrective measures alternative involves the application of land use restrictions to ensure that the current land use (i.e., military) does not change to residential or other unauthorized use in the future. Alternative 1 includes no active corrective measures.

These restrictions would be incorporated into TEAD's master land use plan. This plan also calls for inspections and monitoring to ensure the restrictions are being observed. Because U.S. Army regulations direct that all revisions to this plan be evaluated with regard to potential impacts to human health and the environment, authorization for another (i.e., nonmilitary) use of SWMU 37 requires the resolution of conflicts between identified risks and hazards and proposed changes in land use at the site.

The real property planning board has authority over land use at the base, and is responsible for developing, enforcing, and modifying the installation's master land use plan. The authority of the board is derived from the responsible major Army command (i.e., OSC), which has specific oversight functions. These responsibilities include approving the installation's master land use plan and any proposed changes. Appendix C of the CMS Work Plan (Dames & Moore, 2000) presents a more detailed description of land use restrictions.

Alternative 1 – land use restrictions – is evaluated as follows:

- Technical evaluation

  - Performance – Land use restrictions limit future exposure by preventing future residential development of the site and also meet the CAOs (assuming a 10^{-4} depot worker risk level is acceptable) developed in the CMS Work Plan (Dames & Moore, 2000). This corrective measures alternative is applicable to both site and contaminant characteristics, and meets the identified CAOs with no decrease in effectiveness over time.

  - Reliability – Land use restrictions are effective over the long term and have been implemented at many sites with positive results. No additional exposure should occur while the restrictions are in place. No O&M, management of waste materials, or long-term environmental monitoring is required.

  - Implementability – Because SWMU 37 is currently under military use, continuing land use restrictions at this site should not be difficult.

- Safety – No intrusive activities are required for implementation of this alternative.

- Human health assessment – Restricting future development of the site protects human health by preventing residential exposure to the previously identified contaminants in soil at SWMU 37. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs (assuming a 10^{-4} risk level) but above residential use CAOs.

- Environmental assessment – Although this alternative does not reduce ecological risk, the SWERA concluded that the ecological risk at SWMU 37 does not warrant corrective measures.

- Administrative feasibility – Because SWMU 37 is to remain under U.S. Army control, land use restrictions will be administered through the installation's real property planning board; therefore, this alternative is considered to be administratively feasible.

- Cost – The estimated cost of implementing this corrective measures alternative is $12,000. Table A-15 (see Appendix A) presents the detailed cost estimate.

8.3 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVE

Based on the above evaluation, Alternative 1 – land use restrictions – is recommended as the preferred alternative for SWMU 37 because:

- It meets the requirements of UAC R315-101.
- It has been demonstrated at other sites.
- It is reliable and implementable.

9.0 BOMB WASHOUT BUILDING (SWMU 42)

Section 9.0 evaluates corrective measures alternatives for the Bomb Washout Building (SWMU 42; Figure 9-1). Data from the CMS Work Plan (Dames & Moore, 2000), the human health RA (Montgomery Watson, 1997), and the SWERA (Rust E&I, 1997) are also summarized below.

9.1 SUMMARY OF RAs AND CMS WORK PLAN

Figure 9-1 shows the layout and location of SWMU 42. The Bomb Washout Building (Building 539) is located in the southeastern portion of TEAD, north of the Administration Area. The building previously contained a demilitarization furnace for small arms munitions; it was dismantled in 1960.

From the early 1940s until 1960, projectiles from small arms were burned in the demilitarization furnace. Lead from this process was reclaimed in troughs located beneath the furnace. Because the smokestack did not have air pollution controls, heavy particulates settled into a "drop-out box" located on the roof. When Building 539 was cleaned, washwater was discharged via a steel-lined concrete flume that extends from the northeast corner of the building. The flume runs east-west approximately 10 feet north of the building and discharges into an open ditch to the west. The ditch extends approximately 600 feet to a former unlined holding pond south of the main line railroad tracks. The pond, which is currently overgrown, is 50 feet in diameter and 1 to 2 feet deep (Montgomery Watson, 1997).

Until recently, Building 539 was used for storage. At the time of the Phase II RFI (Montgomery Watson, 1997), it had been renovated. It is now a vehicle washing and staging facility for the U.S. Marine Corps. A concrete parking area was added to the south of the building, and a barbed wire fence was placed around the perimeter.

A second furnace, reportedly the same size as the one in Building 539, was located approximately 225 feet to the north and operated during the same period. It was not enclosed, and was used to incinerate fuses and small munitions. In addition, two deactivation furnaces were located in Building 520 (located east of Building 539) from the 1950s to 1967. These two furnaces were used for popping primers and melting lead for recycling; furnace emissions were exhausted through 25- to 30-foot-high smokestacks (Crist and McIntyre, 1993).

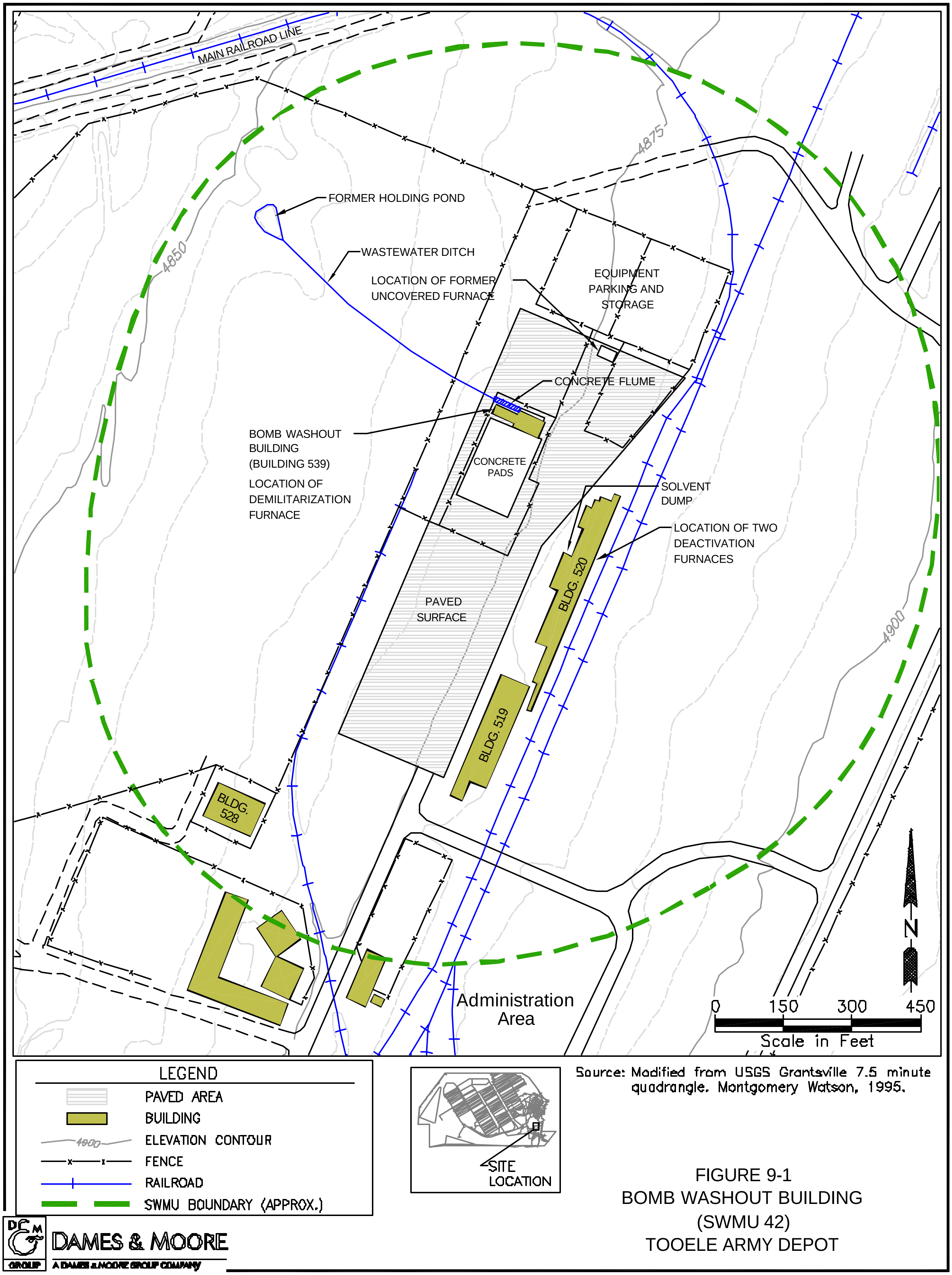
The Phase II RFI (Montgomery Watson, 1997) identified unacceptable risks, hazards, and blood lead levels to human health at SWMU 42 under the hypothetical future residential land use scenario. Therefore, according to EPA guidance and UAC R315-101-6(c)(3), this SWMU is included in the CMS process, and corrective measures must be evaluated. In addition, unacceptable hazards and blood lead levels were identified for the realistic future military and construction worker scenario. Therefore, according to EPA guidance and UAC R315-101-6(d), active corrective measures are evaluated at this site.

During the Phase II RFI (Montgomery Watson, 1997), surficial debris – including demilitarized bullets, brass, slag, and ash – and numerous items of potential UXO were encountered during a geophysical survey of a 38-acre field west and north of Building 539. Seven test pits were excavated during the survey; sampling of two of the test pits revealed no evidence of burial or soil disturbance below approximately 1 to 1.5 feet bgs. However, several practice projectile rounds, cluster bomb submunition, and live small arms ammunition were found in the test pits. Appendix E presents the SWMU 42 geophysical survey results and the summary of explosive risk as presented in the Phase II RFI. Because UXO was encountered during the field investigations, this SWMU is subject to the Munitions Rule.

No groundwater monitoring was conducted at SWMU 42. However, according to the Phase II RFI (Montgomery Watson, 1997), the site constituents are not expected to affect groundwater based on the tendency of these constituents to adsorb to soil, low precipitation rates, high evaporation rates, alkaline soil conditions, the fact that elevated contaminant concentrations were generally limited to depths of 2 feet bgs or less, and depth to groundwater (which is estimated to be 400 feet bgs).

The SWERA (Rust E&I, 1997) indicated that the contaminants detected in soil at SWMU 42 "are likely to pose excessive or unacceptable risks to birds, mammals, soil fauna, and plants." Thus, it recommended that the CMS consider ecological risks (in addition to human health risks) in assessing corrective measures for the site. Ecological risk drivers are discussed in Appendix B. As noted in Section 9.2, the evaluation of corrective measures alternatives for SWMU 42 includes assessment of the ability of each alternative to reduce ecological risks to acceptable levels.

The CMS Work Plan (Dames & Moore, 2000) identified COCs by comparing the maximum concentration of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) to the respective quantitative CAO. Based on this evaluation, antimony, arsenic, beryllium, lead, thallium, 2,4-dinitrotoluene (2,4-DNT), and dioxins/furans were determined to be COCs for surface soil. The following table shows the maximum concentrations and EPCs of the identified COCs in surface soil compared to the CAOs:



Source: Modified from USGS Grantsville 7.5 minute quadrangle. Montgomery Watson, 1995.

FIGURE 9-1
BOMB WASHOUT BUILDING
(SWMU 42)
TOOELE ARMY DEPOT

Bomb Washout Building (SWMU 42)			
COC (Surface Soil)	Maximum Concentration (µg/g)	EPC (µg/g)	CAO (µg/g)
Antimony	5,300	390	160
Arsenic	77	21	32
Beryllium	3	0.6	1.5
Lead	100,000	12,000	1,800
Thallium	200	25	120
2,4-DNT	53	5.6	4.6
Dioxins/furans	3.1×10^{-5}	1.5×10^{-5}	1.5×10^{-5}

Antimony, arsenic, and lead were also determined to the COCs for subsurface soil. The comparison between the maximum concentrations and EPCs of these subsurface soil COCs and their respective CAOs is as follows:

Bomb Washout Building (SWMU 42)			
COC (Subsurface Soil)	Maximum Concentration (µg/g)	EPC (µg/g)	CAO (µg/g)
Antimony	593	190	470
Arsenic	49	13	32
Lead	37,000	6,300	1,800

The COCs identified in surface and subsurface soil were evaluated in conjunction with the results of the human health RA to determine whether active corrective measures need to be evaluated. As stated in the Phase II RFI (Montgomery Watson, 1997), the human health RA used the EPC, which represents the likely concentration that an individual would be exposed to by working in the area of the SWMU, to calculate human health risks. The EPC for each COC in both surface and subsurface soil was compared to the respective CAO, as shown in the above tables.

Based on this comparison, which is described in detail in the CMS Work Plan (Dames & Moore, 2000), the human health risks associated with arsenic, beryllium, thallium, 2,4-DNT, and dioxins/furans in surface soil under the realistic future land use scenario were concluded to be negligible. It should be noted that the maximum concentrations of 2,4-DNT and dioxins/furans are less than one-eighth of their CAOs if a 10^{-4} risk level is considered acceptable. The EPCs for lead and antimony in surface soil are approximately seven and 2.4 times as high as their respective CAOs. In the case of subsurface soil, the EPC for lead is approximately three and one-half times as high as the CAO for lead, and the EPCs for antimony and arsenic are below their respective CAOs. The detected concentrations of lead in surface and subsurface soil were estimated to result in Depot and construction workers' blood lead levels above the applicable CDC target. In addition, in the human health RA (Montgomery Watson, 1997), the EPCs for antimony in both surface and subsurface soil were estimated to result in unacceptable HI values. Based on these evaluations, the CMS Work Plan identified active corrective measures (i.e., treatment technologies) as well as management measures to address the elevated concentrations of lead and antimony in both surface and subsurface soil.

The extent of contamination at SWMU 42 was estimated in the CMS Work Plan (Dames & Moore, 2000) and is shown on Figure 9-2. Also highlighted are the COC locations that helped define the areas and volumes of contaminated soil.

Based on the soil sampling data presented in detail in the Phase II RFI (Montgomery Watson, 1997), the contaminated soil is assumed to extend to an average depth of 3 feet bgs. This is a conservative depth based on elevated antimony and lead in surface and subsurface locations. The total area of contaminated soil is estimated to be 31,800 ft^2. The total volume of contaminated soil is approximately 3,530 yd^3.

In addition to the previously discussed quantitative CAOs, the CMS Work Plan (Dames & Moore, 2000) presented qualitative CAOs for SWMU 42 to comply with UAC R315-101, as follows:

- To protect other media from further degradation (i.e., to ensure that levels of contamination do not increase beyond existing levels, per UAC R315-101-3).

- To protect human health and the environment in accordance with Federal, State, and local regulatory requirements.

- To ensure that – if the current military land use scenario changes in the future to residential or other use – appropriate measures are taken to adequately protect human health and the environment.

The CMS Work Plan (Dames & Moore, 2000) identified four alternatives to address lead and antimony in both surface and subsurface soil at the Bomb Washout Building, as follows:

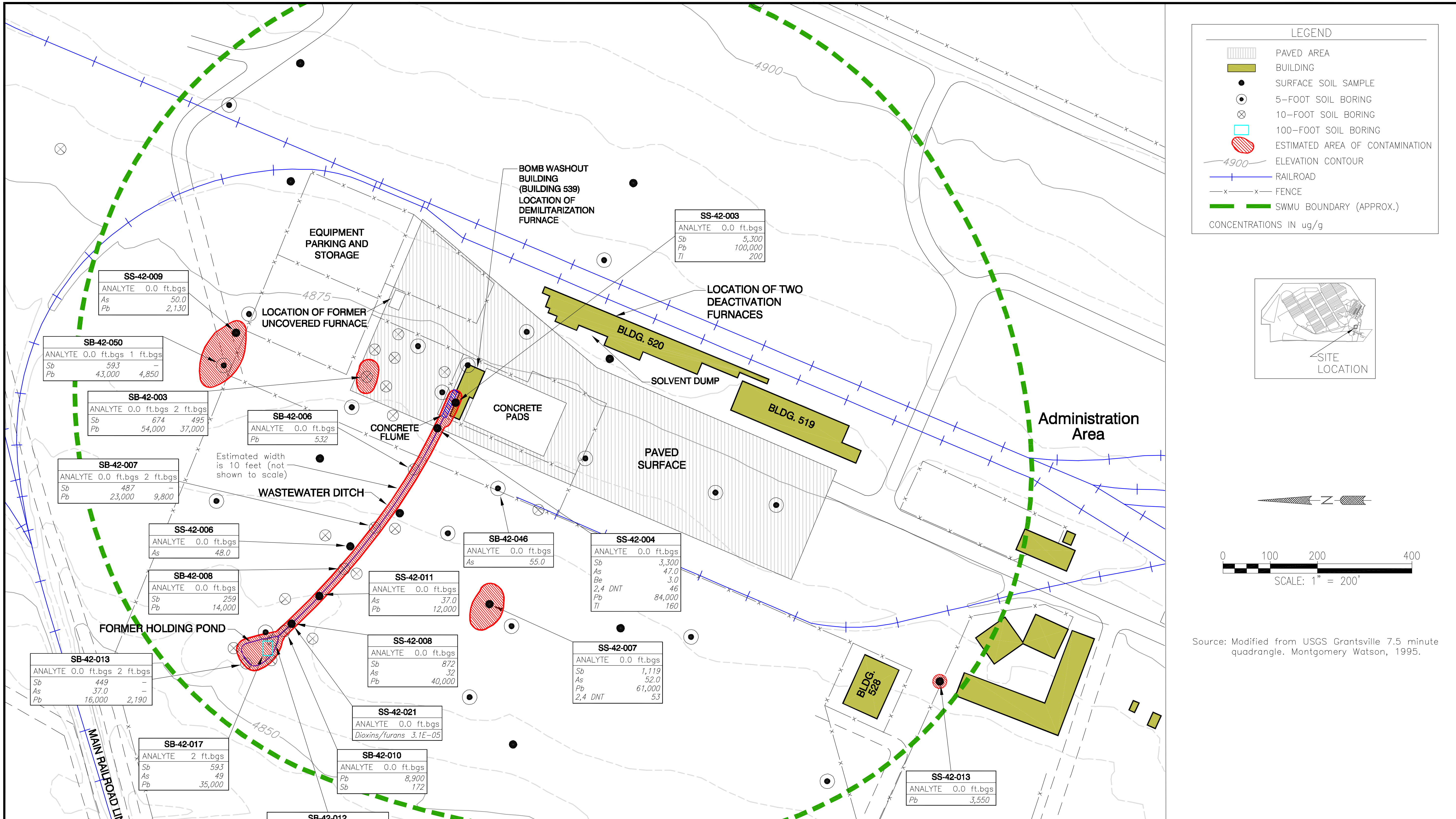


FIGURE 9-2
COC LOCATIONS AND APPROXIMATE AREA OF CONTAMINATION
BOMB WASHOUT BUILDING
(SWMU 42)
TOOELE ARMY DEPOT

DAMES & MOORE
GROUP A DAMES & MOORE GROUP COMPANY

SWMU 42	Corrective Measures Alternative
BOMB WASHOUT BUILDING	**Soil cover, fence, and land use restrictions** Install soil cover over impacted area Periodically inspect and maintain cover and existing fence Impose land use restrictions to prevent residential development **Excavation, solidification/stabilization, and land use restrictions** Excavate contaminated soil Fill and compact with clean soil Solidify/stabilize excavated soil on post by mixing with chemical reagents Impose land use restrictions to prevent residential development **Excavation, soil washing, and land use restrictions** Excavate contaminated soil Treat excavated soil on post by soil washing and segregate fine soil portion Backfill excavation with treated soil, cover with clean soil, and revegetate Characterize, transport, and treat/dispose of metals-contaminated soil off post in accordance with U.S. Army protocols and State and Federal regulations Impose land use restrictions to prevent residential development **Excavation, off-post treatment/disposal, and land use restrictions** Excavate contaminated soil Fill and compact with clean soil Characterize, transport, and treat/dispose of contaminated soil off post in accordance with U.S. Army protocols and State and Federal regulations Impose land use restrictions to prevent residential development

Because the Phase II RFI (Montgomery Watson, 1997) indicated that UXO may be present at SWMU 42, UXO clearance operations are included in each of these alternatives to ensure remediation worker safety.

Table 9-1 summarizes the risks to human health and the environment evaluated in the Phase II RFI (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997), and the corrective measures alternatives identified for SWMU 42 in the CMS Work Plan (Dames & Moore, 2000).

TABLE 9-1

Summary of Phase II RFI, SWERA, and CMS Work Plan
Bomb Washout Building (SWMU 42)

Phase II RFI (Montgomery Watson, 1997)									**SWERA (Rust E&I, 1997)**	**CMS Work Plan (Dames & Moore, 2000)**	
Human Health Risk Assessment (a)								**Impacts to Groundwater**	**Ecological Risk**	**COCs (b)**	**Corrective Measures Alternative (c)**
Hypothetical Future Residential Land Use Scenario (d)				**Realistic Future Land Use Scenario (e)**							
	Risk	**HI**	**Blood Lead Level (f)**		**Risk**	**HI**	**Blood Lead Level (f)**				
Adult	**3×10^{-2}**	NE	NE(g)	Military	2×10^{-6}	**3**	**18.1**	None	Potentially Unacceptable	Surface soil: Antimony Arsenic Beryllium Lead Thallium 2,4-DNT Dioxins/furans Subsurface soil: Antimony Arsenic Lead	***Soil cover, fence, and land use restrictions*** Excavation, solidification/ stabilization, and land use restrictions Excavation, soil washing, and land use restrictions Excavation, off-post treatment/ disposal, and land use restrictions
Child	NE	**200**	**54**	Construction	3×10^{-6}	**4**	**16.2**				

(a) Risks, HIs, and blood lead levels that are above comparison levels appear in bold type.
(b) Arsenic, beryllium, thallium, 2,4-DNT, and dioxins/furans result in negligible risk to human health. The corrective measures evaluated in the CMS Report focus on lead and antimony contamination only.
(c) The selected corrective measures alternative appears in bold italic type
(d) EPA guidance and UAC R315-101-5.2(b)(1) require evaluation of the hypothetical future land use scenario. Because risks and HIs are greater than 1×10^{-6} and 1.0, respectively, EPA guidance and UAC R315-101-6(c)(3) indicate that a CMS must be performed.
(e) EPA guidance and UAC R315-101-5.2(b)(2) require evaluation of the realistic future land use scenario. Because the HI is above the regulatory goal of 1.0, UAC R315-101-6(d) indicates that active corrective measures must be evaluated.
(f) Blood lead levels are expressed as micrograms per deciliter (µg/dL) for 95 percent of the population (should not exceed 10 µg/dL).
(g) NE = pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).

9.2 DETAILED EVALUATION OF CORRECTIVE MEASURES ALTERNATIVES

Section 9.2 evaluates the four corrective measures alternatives for the Bomb Washout Building (SWMU 42). Each of the alternatives includes land use restrictions, which are described in detail in Section 9.2.1; and UXO clearance, which is described in the CMS Work Plan (Dames & Moore, 2000). A UXO clearance must be performed over the areas where corrective actions will occur (including all access routes). The land use restrictions will include a notation that prohibit Depot worker activities from occurring at the site unless ordnance personnel have performed a UXO clearance for the intended area of use.

9.2.1 Alternative 1 – Soil Cover, Fence, and Land Use Restrictions

This corrective measures alternative includes consolidating the contaminated soil at SWMU 42, as shown on Figure 9-2, and placing it in the former ditch and holding pond area prior to installation of the soil and PVC liner cover. A UXO clearance is performed before work begins. Four separate areas of contaminated soil are located in unpaved portions of the site. It is assumed that the contaminated soil in the three isolated areas – with an estimated total area of 15,650 ft^2 and total volume of 1,740 yd^3 – is excavated and placed in the ditch/holding pond area. Confirmation samples are collected from these areas only, and analyzed for lead and antimony. Excavation and confirmatory sampling continue until the quantitative CAOs for these metals are achieved. The excavated areas are then backfilled with clean soil from an on-post borrow pit. The backfilled areas will be graded and covered with vegetation to prevent surface water ponding and to minimize erosion. (Two other areas of contaminated soil are located at SB42003 (2,650 ft^2), which is already paved and beneath the floor of Building 539 and the paved surface surrounding the building. This soil left in place. The paved surfaces in the vicinity of these two areas are inspected and repaired as necessary to ensure that the contaminants are effectively contained.)

After consolidating the soil in the ditch/holding pond, additional clean soil is used to fill the depression (raising it to approximately grade level); and a PVC liner and a 1-foot-thick soil cover is placed over this area, which is estimated to be 13,500 ft^2. The soil cover is constructed using clean soil from an on-post borrow pit, and the soil is placed in engineered, compacted lifts. The cover is graded for positive drainage at a minimum slope of 2 percent and vegetated with grass or similar native species to minimize erosion. The cap shall be designed and installed to prevent the formation of channels of water under the cap and prevent contaminant migration due to drainage culverts. The SWMU 42 area is already surrounded by a barbed wire fence. Annual inspections are conducted to verify that the soil cover and fence have not been damaged. The soil cover and fence are maintained as necessary.

In addition, this alternative also includes land use restrictions to prevent future residential development at SWMU 42. Land use restrictions would be incorporated into TEAD's master land use plan. This plan also calls for inspections and monitoring to ensure the restrictions are being observed. Because U.S. Army regulations direct that all revisions to this plan be evaluated with regard to potential impacts to human health and the environment, authorization for another (i.e., nonmilitary) use of SWMU 42 requires the resolution of conflicts between identified risks and hazards and proposed changes in land use at the site. The land use restrictions will state that contamination removal must be evaluated if the property changes ownership or is used for any purpose that could disturb the cover. The land use restrictions will include a notation that prohibit Depot worker activities from occurring at the site unless ordnance personnel have performed a UXO clearance for the intended area of use (clearance will have occurred in the areas affected by the corrective measure). The SWMU will have signage posted to warn of UXO potential and stating the access restrictions. In addition, the entire TEAD facility is secured by fences and patrolled by guards.

The real property planning board has authority over land use at the base, and is responsible for developing, enforcing, and modifying the installation's master land use plan. The authority of the board is derived from the responsible major Army command (i.e., OSC), which has specific oversight functions. These responsibilities include approving the installation's master land use plan and any proposed changes. Appendix C of the CMS Work Plan (Dames & Moore, 2000) presents a more detailed description of land use restrictions.

Alternative 1 – soil cover, fence, and land use restrictions – is evaluated as follows:

- <u>Technical evaluation</u>

  – <u>Performance</u> – The installation/maintenance of a soil cover and fence and the application of land use restrictions comply with UAC-R315-101-3, the "Principle of Non-Degradation," by preventing the migration of lead and antimony from soil to other environmental media. Although the cover is not a permanent remedy and the soil containing lead and antimony concentrations above the quantitative CAOs for these COCs is left in place, Alternative 1 achieves the qualitative CAOs developed in the CMS Work Plan (Dames & Moore, 2000) by preventing human exposure to the contaminated soil. This alternative is applicable to both site and contaminant characteristics; as long as the soil cover and fence are properly maintained, it meets the identified CAOs with no decrease in effectiveness over time.

  – <u>Reliability</u> – Maintenance and annual inspection of the soil cover and fence are required to ensure the long-term effectiveness of this alternative. No Depot worker exposure to the identified contamination will occur while the soil cover and fence are in place. Although land use restrictions are effective over the long term and have been implemented at many sites with positive results, they do not permanently remove site contamination. Alternative 1 does not require the management of waste materials or long-term environmental monitoring. Some degree of long-term liability is associated with the contaminated soil covered but still remaining onsite.

– Implementability – Equipment and materials required for excavating the contaminated soil from the isolated affected areas, placing the soil in the ditch/holding pond area, and installing/maintaining the soil cover and fence are readily available. Continuing land use restrictions at this site should not be difficult because the specified future land use for SWMU 42 is continued military use. Approximately 2 months is required to complete site construction activities and to achieve the qualitative CAOs.

– Safety – This alternative poses low short-term risks to onsite workers, primarily because of the excavation and handling of contaminated soil and potential UXO. Such exposure may occur during excavation of soil at the isolated affected areas, or during on-post transport and placement of the soil in the ditch/holding pond area. However, Alternative 1 includes appropriate precautionary measures, as necessary (e.g., UXO clearance, dust suppression and personal protective equipment).

- Human health assessment – Placing a soil cover over the ditch/holding pond area, maintaining a fence, and restricting future development of the site protect human health by preventing both short- and long-term exposure to contaminated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – The soil cover is expected to reduce the risk to ecological receptors at SWMU 42 by reducing exposure of the receptors to COPCs at the site. Alternative 1 is estimated to reduce the identified risks to passerine birds, deer mice, jackrabbits, soil fauna, and plants by 80, 71, 77, 80, and 78 percent, respectively. With these reductions, the site is estimated to present a low ecological risk to all receptors in accordance with the definitions and methodology of the SWERA (Rust E&I, 1997).

- Administrative feasibility – By preventing exposure to contaminated soil, this alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust.

- Cost – The estimated present worth cost of implementing Alternative 1 is $520,000. Table A-16 (see Appendix A) presents the detailed cost estimates.

9.2.2 Alternative 2 – Excavation, Solidification/Stabilization, and Land Use Restrictions

This corrective measures alternative includes excavation of the affected soil (see Figure 9-2) using an excavator, backhoe, or similar equipment. As discussed in Section 9.1, the estimated total area and volume of contaminated soil to be excavated are 31,800 ft^2 and 3,530 yd^3, respectively. The affected areas shown on Figure 9-2 are to be excavated to an average depth of 3 feet. This alternative includes the collection of confirmatory soil samples from the floor and each sidewall of the excavation, and analysis for lead and antimony. Excavation and confirmatory sampling continue until the quantitative CAOs for these metals are achieved.

The metals-contaminated soil is transported to an on-post location (agreed to by the Army and regulatory agencies), where it is solidified/stabilized and placed in a CAMU at SWMU 12/15 (Known Releases). In this process, cement or other chemicals or a proprietary binding agent is used to solidify and stabilize the homogenized soil. A cement-based process is selected for Alternative 2 because of its versatility in immobilizing metals. Pretreatment optimization, performed as part of the alternative, may indicate that another solidification/stabilization agent is more effective. TCLP is used to evaluate the effectiveness of stabilization. The stabilized soil that meets TCLP standards is then placed within the CAMU, where it is allowed to cure in place.

The objective of solidification/stabilization is to treat the contaminated soil to below applicable regulatory levels (e.g., TCLP). Pretreatment testing is required to evaluate the effectiveness of the technology and to obtain optimum design criteria. Confirmation sampling verifies that the soil is stabilized and regulatory levels are met. Clean soil from an on-post borrow area is backfilled into excavated areas, which are graded and covered with vegetation to prevent surface water ponding and to minimize erosion.

Pretreatment optimization is required prior to final design of the solidification/stabilization alternative to evaluate the effectiveness of this technology on the metals-contaminated soil from the site, and to select the stabilization reagent formulation. TCLP tests are conducted to evaluate the ability of the solidification/ stabilization process to convert the contaminated soil to a nonhazardous material in accordance with RCRA. The tests are expected to produce information on the strength, durability, volume increase, and long-term integrity of the stabilized material, and on design criteria for the treatment process. For purposes of the CMS, it is assumed that Portland cement is the primary reagent to be used, and that the volume increase due to treatment of the soil is 20 percent. Five-year inspections – to include sample collection and analysis – are conducted to confirm the long-term effectiveness of the solidification/ stabilization process.

Alternative 2 also includes land use restrictions to prevent future residential development at SWMU 42, as described in Section 9.2.1, and UXO clearance prior to any excavation activities.

Alternative 2 – excavation, solidification/stabilization, and land use restrictions – is evaluated as follows:

- Technical evaluation

  - Performance – The treatment of contaminated soil by solidification/ stabilization and the application of land use restrictions comply with UAC-R315-101-3, the "Principle of Non-Degradation," by preventing the migration of lead and antimony from soil to other environmental media. The qualitative CAOs developed in the CMS Work Plan (Dames & Moore, 2000) are expected to be achieved by protecting human health and the environment as a result of the immobilization of these metals in the treated soil. This alternative is applicable to both site and contaminant characteristics and is likely to meet the identified CAOs with no decrease in effectiveness over time. In addition, the land use restrictions limit future residential development and potential exposure to lead and other contaminants in untreated soil at the site.

    This alternative requires pretreatment testing to confirm the effectiveness of solidification/stabilization for classifying the metals-contaminated soil as nonhazardous based on TCLP test results. Although solidification/ stabilization is considered to be a permanent treatment process, there is a potential for the eventual breakdown of the material and release of contained metals. The pretreatment optimization is expected to more clearly quantify this potential.

  - Reliability – Solidification/stabilization and land use restrictions are expected to be effective over the long term and have been implemented effectively at many sites. Management of waste materials is limited to contaminated soil. Pretreatment testing confirms whether solidification/ stabilization can achieve the CAOs. Land use restrictions prevent future residential exposure to contaminated soil at the site. Some degree of long-term liability may be associated with return of the stabilized soil to the CAMU at SWMU 12/15 (Known Releases). Five-year inspections are conducted to confirm the long-term effectiveness of the solidification/stabilization process.

  - Implementability – Excavation equipment for this alternative is readily available; however, the number of vendors with experience in using this treatment method for contaminated soil may be limited. Because Alternative 2 requires excavation, the presence of subsurface utilities may also affect its implementation. Continuing land use restrictions at this site should not be difficult because the specified future land use for SWMU 42 is continued military use. Approximately 2 to 3 months is required to complete the excavation, solidification/stabilization, and backfilling activities, and to meet the CAOs.

– Safety – This alternative poses low short-term risks to onsite workers, who may be exposed to contaminated soil during excavation and solidification/stabilization operations and due to potential UXO. However, it includes appropriate precautionary measures, as necessary (e.g., UXO clearance, dust suppression and personal protective equipment).

- Human health assessment – Excavating and solidifying/stabilizing contaminated soil, and restricting future residential development of the site, protect human health by preventing both short- and long-term exposure to untreated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – The risk to ecological receptors at SWMU 42 is reduced by treating the contaminated soil and placing the solidified/stabilized soil in an offsite CAMU. Alternative 2 is estimated to reduce the identified risks to passerine birds, deer mice, jackrabbits, soil fauna, and plants by 80, 71, 77, 80, and 78 percent, respectively (see Appendix B). With these reductions, the site is estimated to present a low ecological risk to the above receptors in accordance with the definitions and methodology of the SWERA (Rust E&I, 1997).

- Administrative feasibility – This alternative likely complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by treating affected soil, thereby reducing the risk to human health. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust. Obtaining permission to place stabilized soil at SWMU 12/15 may present administrative difficulties.

- Cost – The estimated present worth cost of implementing this corrective measures alternative is $1,280,000. Table A-17 (see Appendix A) presents the detailed cost estimate.

9.2.3 Alternative 3 – Excavation, Soil Washing, and Land Use Restrictions

This corrective measures alternative includes excavation of the affected soil (see Figure 9-2) using an excavator, backhoe, or similar equipment. As discussed in Section 9.1, the estimated total area and volume of contaminated soil to be excavated are 31,800 ft^2 and 3,530 yd^3, respectively. The areas shown on Figure 9-2 are to be excavated to an average depth of 3 feet. This alternative includes the collection of confirmatory soil samples from the floor and each sidewall of the excavation, and analysis for lead and antimony. Excavation and confirmatory sampling continue until the quantitative CAOs for these metals are achieved.

Prior to onsite soil washing, the excavated soil from the affected areas is blended and stockpiled. The first step of soil washing is separation of the contaminated soil into coarse and fine fractions. Screens are used to remove large rocks and other debris; water or proprietary solution is then added to a trommel or other size classification device, where the soil is separated into coarse- and fine-grained particles.

Most of the lead and antimony present in the contaminated soil is concentrated in the fines, which may be further treated using an acid leach. However, if the fines cannot be treated to cleanup objectives, the soil is sent offsite for treatment/disposal. Because the concentrations of lead and antimony are expected to be high, it is assumed that the fines are classified as hazardous waste in accordance with applicable RCRA (i.e., TCLP test) criteria, and that they are shipped off post for disposal at a Subtitle C hazardous waste landfill. The fines are expected to require pretreatment (i.e., solidification/ stabilization) at the selected TSDF facility to comply with RCRA LDRs prior to disposal in the landfill.

Large rocks, debris, and coarse-grained particles that meet applicable TCLP levels for the above contaminants are returned to the areas from which they were excavated. In addition, clean soil from an on-post borrow area is backfilled in the excavated areas, as necessary. The backfilled areas are then graded and covered with a 6 inch vegetated soil cover built to prevent surface water ponding and to minimize erosion. If the soil washwater or proprietary solution contains excessive amounts of lead or other contaminants, it is treated onsite using ion exchange resins or another appropriate treatment method.

Pretreatment testing is required prior to final design of this alternative to evaluate the effectiveness of this technology on soil from SWMU 42 and to develop optimal process design criteria.

Alternative 3 also applies land use restrictions to prevent future residential development at SWMU 42, as described in Section 9.2.1, and UXO survey and clearance prior to excavation activities.

Alternative 3 – excavation, soil washing, and land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – Excavation and soil washing of contaminated soil is likely to meet both the quantitative and qualitative CAOs (see Section 9.1) developed in the CMS Work Plan (Dames & Moore, 2000). This alternative complies with UAC-R315-101-3, the "Principle of Non-Degradation," by treating the contaminated soil. In addition, land use restrictions prevent future residential development and potential exposure to residual contaminants in soil. Alternative 3 meets the identified CAOs with no decrease in effectiveness over time. However, the effectiveness of soil washing needs to be determined by pretreatment testing. If the percentage of fines in the contaminated soil is greater than approximately 30 percent, the effectiveness of this process may be limited.

– Reliability – Soil washing and land use restrictions are effective over the long term, and have been implemented effectively at many sites. Alternative 3 eliminates Depot worker and future construction worker exposure to contaminated soil at the site, and prevents potential future residential exposure to residual contaminants. After the washed material has been backfilled in the excavated areas, no additional management of waste materials or long-term environmental monitoring is required. Some degree of long-term liability is associated with the placement of contaminated soil in a landfill.

– Implementability – Equipment for excavation and soil washing are readily available, and a Subtitle C landfill and TSDF are located within 100 miles of TEAD. Because this alternative requires excavation, the possible presence of subsurface utilities may affect its implementation. Continuing land use restrictions at this site should not be difficult because the specified future land use for SWMU 42 is continued military use. The number of vendors experienced in using this treatment technology is limited. Approximately 2 to 3 months is required to complete the excavation, soil washing, and backfilling activities, and to meet the CAOs.

– Safety – Alternative 3 poses moderate short-term risks to off-post residential communities and onsite workers. Residential communities may be exposed to contaminated soil during transportation and off-post treatment/disposal of residuals. Onsite workers may be exposed to contaminated soil during excavation, soil washing, and other soil-handling activities, and UXO may exist at the site. However, this alternative includes appropriate precautionary measures, as necessary (e.g., UXO clearance, dust suppression, and personal protective equipment).

- Human health assessment – Excavating and washing contaminated soil, and restricting future development of the site, protect human health by preventing both short- and long-term exposure to contaminated soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment—The risk to ecological receptors at SWMU 42 is reduced by using soil washing to treat the contaminated soil – which decreases the concentrations of lead and other COPCs – and returning the cleaned soil to excavated areas. Alternative 3 is estimated to reduce the identified risks to passerine birds, deer mice, jackrabbits, soil fauna, and plants by 72, 59, 59, 46, and 51 percent, respectively. With these reductions, the site is estimated to present low-to-moderate ecological risks to the above receptors in accordance with the definitions and methodology of the SWERA (Rust E&I, 1997).

- Administrative feasibility – This alternative complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by using soil washing to reduce the concentrations of the metal contaminants in soil. Because the concentrations of lead and antimony in soil are reduced to meet the applicable quantitative CAOs for these metals, Alternative 3 meets the human health risk criterion under UAC R315-101-6. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust. The excavated soil that is shipped off post is transported in accordance with DOT regulations.

- Cost – The estimated present worth cost for implementing Alternative 3 is $1,630,000. Table A-18 (see Appendix A) presents the detailed cost estimate.

9.2.4 Alternative 4 – Excavation, Off-Post Treatment/Disposal, and Land Use Restrictions

This corrective measures alternative includes excavation of the affected soil (see Figure 9-2) using an excavator, backhoe, or similar equipment. As discussed in Section 9.1, the estimated total area and volume of contaminated soil to be excavated are 31,800 ft^2 and 3,530 yd^3, respectively. The areas shown on Figure 9-2 are to be excavated to an average depth of 3 feet. This alternative includes the collection of confirmatory soil samples from the floor and each sidewall of the excavation, and analysis for lead and antimony. Excavation and confirmatory sampling continue until the quantitative CAOs for these metals are achieved.

The excavated soil undergoes a soil profile analysis to determine if the soil exhibits a listed or characteristic RCRA hazardous waste. A preliminary review of the site contaminants and potential waste processes contributing to the contamination at SWMU 42 suggest that the metals in soil are not listed wastes. However, the contaminant data suggests that lead will exceed TCLP regulatory levels and the soil will therefore exhibit a RCRA characteristic waste. A final waste determination will be made during the corrective action phase. A review of other regulations (e.g., State of Utah, DOT) and additional testing (e.g., TCLP) will be necessary to make this determination

If the soil is classified as containing a hazardous waste in accordance with RCRA or other applicable criteria, it is transported to an off-post Subtitle C hazardous waste landfill for direct disposal (if concentrations meet LDR guidelines) or to a TSDF for treatment prior to disposal. For purposes of this CMS, it is assumed that the contaminated soil is sent to a TSDF for pretreatment by solidification/stabilization to comply with applicable RCRA LDRs prior to disposal in the landfill. However, if the soil profile results are acceptable, the soil could be sent to an off-post Subtitle D landfill for disposal. The excavated soil is transported and manifested in compliance with applicable regulations. Clean soil from an on-post borrow site is backfilled in the excavated areas, upon which are placed graded vegetative covers to prevent surface water ponding and to minimize erosion.

Alternative 4 also includes land use restrictions to prevent future residential development at SWMU 42, as described in Section 9.2.1, and UXO survey and clearance prior to excavation of soil.

Alternative 4 – excavation, off-post treatment/disposal, and land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – Excavation and off-post treatment/disposal of contaminated soil meet both the qualitative and quantitative CAOs (see Section 9.1) developed in the CMS Work Plan (Dames & Moore, 2000). This alternative also complies with UAC-R315-101-3, the "Principle of Non-Degradation," by removing the contaminated soil from the site. Alternative 4 meets the identified CAOs with no decrease in effectiveness over time. In addition, land use restrictions prevent future residential development of SWMU 42 and potential exposure to residual contaminants in soil.

  – Reliability – Excavation and off-post treatment/disposal, and land use restrictions, are effective over the long term and have been implemented effectively at many sites. Alternative 4 eliminates Depot worker and future construction worker exposure to contaminated soil at the site, and prevents potential future residential exposure to residual contaminants. No management of waste materials or long-term environmental monitoring is required at SWMU 42. However, some degree of long-term liability is associated with the disposal of contaminated soil in an off-post landfill. Management and monitoring are required at the landfill.

  – Implementability – Excavation equipment for this alternative is readily available, and a Subtitle C landfill and TSDF are located within 100 miles of TEAD. Because Alternative 4 requires excavation, the possible presence of subsurface utilities may affect its implementation. Continuing land use restrictions at this site should not be difficult because the specified future land use for SWMU 42 is continued military use. Approximately 1 month is required to complete the excavation, off-post transportation/disposal activities, and backfilling, and to meet the CAOs.

- Safety – Alternative 4 poses moderate short-term risks to off-post residential communities and onsite workers. Residential communities may be exposed to contaminated soil during transportation and off-post treatment/disposal of the soil. Onsite workers may be exposed to contaminated soil during excavation and other soil-handling activities, and UXO may be present at the site. However, this alternative includes appropriate precautionary measures, as necessary (e.g., UXO clearance, dust suppression, and personal protection equipment).

- Human health assessment – Excavation and off-post treatment/disposal of contaminated soil, and restriction of future residential development of the site, protect human health by preventing both short- and long-term exposure to soil. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – Excavation and off-post treatment/disposal of contaminated soil reduce the risk to ecological receptors by removing the contaminated soil from the site. Alternative 4 is estimated to reduce the identified risks to passerine birds, deer mice, jackrabbits, soil fauna, and plants by 80, 71, 77, 80, and 78 percent, respectively. With these reductions, the site is estimated to present a low ecological risk to each of the above receptors in accordance with the definitions and methodology of the SWERA (Rust E&I, 1997).

- Administrative feasibility – Alternative 4 complies with applicable Federal and State laws and regulations, including the requirements of UAC R315-101, by removing the affected soil from the site. Because all soil containing lead and antimony levels above the CAOs for these metals is excavated and removed from SWMU 42, this alternative meets the human health risk criteria under UAC R315-101-6. Contaminated soil is excavated in accordance with UAC R307-12, Fugitive Emissions and Fugitive Dust. The excavated soil is transported in accordance with DOT regulations.

- Cost – The estimated present worth cost of implementing Alternative 4 is $2,120,000. Table A-19 (see Appendix A) presents the detailed cost estimate.

9.3 COMPARATIVE ANALYSIS OF CORRECTIVE MEASURES ALTERNATIVES

Table 9-2 and the text below summarize the comparative analysis of the four corrective measures alternatives developed for the Bomb Washout Building (SWMU 42).

TABLE 9-2

Comparative Analysis of Corrective Measures Alternatives
Bomb Washout Building (SWMU 42) (a)

Corrective Measures Alternative	Technical Evaluation				Human Health Assessment	Environmental Assessment	Administrative Feasibility	Cost
	Performance	Reliability	Implementability	Safety				
1 - Soil cover, fence, and land use restrictions	Moderate	Moderate	High	Moderate	High	High	High	$520,000
2 - Excavation, solidification/ stabilization, and land use restrictions	Moderate	Moderate	Moderate	Moderate	High	High	Moderate	$1,280,000
3 - Excavation, soil washing, and land use restrictions	Moderate	Moderate	Moderate	Low	High	Moderate	Moderate	$1,630,000
4 - Excavation, off-post treatment/ disposal, and land use restrictions	High	High	High	Low	High	High	High	$2,120,000

(a) Rankings indicate how well each alternative meets the evaluation criteria, relative to other alternatives.

- Technical evaluation

  - Performance – Alternative 4 (excavation, off-post treatment/disposal, and land use restrictions) meets both the qualitative and quantitative CAOs and is rated high with respect to performance. Alternative 2 (excavation, solidification/stabilization, and land use restrictions) and Alternative 3 (excavation, soil washing, and land use restrictions) meet both the qualitative and quantitative CAOs, but require pretreatment testing and are rated moderate with respect to performance. Alternative 1 (soil cover, fence, and land use restrictions) is rated moderate for performance because it is not a permanent remedy and it only meets the CAOs if the cover is properly maintained.

  - Reliability – Alternative 4 is rated high for reliability because the technologies have been proven effective at other sites, and no O&M activities or long-term monitoring is required. Alternative 1 is rated moderate because it does not permanently remove site contamination, and it requires annual inspection and maintenance of the fence and soil cover. Alternatives 2 and 3 are rated moderate because pretreatment testing is required to further evaluate their effectiveness and permanence, and 5-year site inspections are recommended to ensure the long-term effectiveness of the solidification/stabilization process.

  - Implementability – Alternatives 1 and 4 are rated high because they are easy to implement. Equipment, materials, and contractors required for implementation are readily available locally. It is estimated that Alternative 1 could be completed within 4 to 6 weeks and Alternative 4 within 1 month. Alternatives 2 and 3 are rated moderate because there are fewer contractors experienced in performing these treatment processes. It is estimated that Alternatives 2 and 3 require 2 to 4 months for implementation.

  - Safety – Alternative 1 is rated moderate for safety because it requires UXO clearance, limited excavation and handling of contaminated soil, and no off-post transport of hazardous materials; it presents no significant short-term risk to off-post residential communities or on-post workers. Alternative 2 is rated moderate because it requires UXO clearance, and involves the excavation and treatment of contaminated soil; it does not include the off-post transport of hazardous materials. Because Alternatives 3 and 4 require UXO clearance, and involve the excavation and handling of contaminated soil, and the off-post shipment of either the soil or the soil-washing treatment residuals to a Class C landfill or TSDF, they are rated low.

- Human health assessment – Alternatives 1, 2, 3, and 4 are protective of human health. Alternative 1 protects human health by containing the COCs at the site beneath the soil cover. Alternative 2 prevents both short- and long-term exposure to untreated soil through solidification/stabilization. Alternative 3 uses soil washing to reduce COC concentrations in the impacted soil. Alternative 4 removes the contaminated soil from SWMU 42. Each of these alternatives receives a high rating for protection of human health.

- Environmental assessment – Alternative 1 is rated high for environmental protection because the soil cover minimizes the exposure of ecological receptors to contaminants at the site. Alternatives 2 and 4 are also rated high because excavation and removal of the contaminated soil are estimated to reduce the risks to ecological receptors to a low level. Alternative 3 is rated moderate because soil washing is estimated to result in low-to-moderate risks to ecological receptors.

- Administrative feasibility – Alternatives 1 and 4 are rated high for administrative feasibility because they meet the requirements of UAC R315-101. Alternatives 2 and 3 receive a moderate rating; though they are expected to meet the requirements of this regulation, they may require a RCRA treatment permit.

- Cost – Of the four corrective measures alternatives, Alternative 1 has by far the lowest cost, estimated to be $520,000. The estimated costs of Alternatives 2, 3, and 4 are $1,280,000, $1,630,000, and $2,120,000, respectively.

9.4 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVE

Based on the comparative analysis presented in Section 9.3, Alternative 1 – soil cover, fence, and land use restrictions – is recommended as the preferred alternative for SWMU 42 because:

- It meets the qualitative CAOs, including protection of human health and the environment and compliance with the "Principle of Non-Degradation" under UAC R315-101-3.

- It has been demonstrated at other sites.

- It is reliable and easy to implement.

- It is safer to implement than the other corrective measures alternatives because it requires minimal excavation and handling of contaminated soil.

- It presents low ecological risks.

- It can be implemented at a much lower cost than the other corrective measures alternatives.

10.0 STORMWATER DISCHARGE AREA (SWMU 45)

Section 10.0 evaluates corrective measures alternatives for the Stormwater Discharge Area (SWMU 45; Figure 10-1). Data from the CMS Work Plan (Dames & Moore, 2000), the human health RA (Montgomery Watson, 1997), and the SWERA (Rust E&I, 1997) are also summarized below.

10.1 SUMMARY OF RAs AND CMS WORK PLAN

As shown on Figure 10-1, the Stormwater Discharge Area (SWMU 45) is located approximately 2,500 feet northwest of the Administration Area. This site covers approximately 4.3 acres, which includes an 2-acre area around an unlined earthen basin and a 10-foot-wide corridor along associated pipelines from the Administration Area's stormwater collection system. Stormwater has been discharged to SWMU 45 since TEAD's construction in 1942. The storm drain system consists of 10,000 linear feet of subsurface pipelines, which are included in the SWMU boundary. Although no industrial operations were performed at the site, it received discharges from the carpenter shop, sign shop, motor pool, rail shop, and pesticide storage area. During the Phase II RFI, ponded stormwater was observed, though it dries up during the summer months.

The Phase II RFI (Montgomery Watson, 1997) identified unacceptable risks, hazards, and blood lead levels to human health at SWMU 45 under the hypothetical future residential land use scenario. Therefore, according to EPA guidance and UAC R315-101-6(c)(3), this SWMU is included in the CMS process, and corrective measures must be evaluated. However, the human health RA concluded that SWMU 45 presents no unacceptable risk to current Depot workers or future construction workers. In addition, because the assumed future land use is continued military use, there is no unacceptable risk under the realistic future land use scenario. Although the hypothetical future residential land use scenario presents unacceptable risks, the realistic future land use scenario presents no unacceptable risks; therefore, management measures are evaluated according to UAC R315-101-1(b)(4).

Groundwater samples were collected from three monitoring wells at SWMU 45 during the Phase II RFI (Montgomery Watson, 1997). It was determined that groundwater components are naturally occurring and that the discharge pond has not affected this medium. In addition, the Phase II RFI concluded that the site constituents detected in the soil, sediment, and surface water are not expected to affect groundwater based on their relatively low concentrations, alkaline soil conditions, and depth to groundwater (which is approximately 350 feet bgs).

The SWERA (Rust E&I, 1997) indicated that the site poses a moderate ecological risk, but that remediation would damage valuable wildlife habitat. For this reason, no corrective measures were recommended to reduce ecological risk at SWMU 45.

In summary, under the military land use scenario at SWMU 45, there are no unacceptable risks or hazards to either human health or the environment; based on this evaluation, management measures are identified per UAC R315-101-1(b)(4). The CAO for SWMU 45 is to ensure that – if the future land use changes – appropriate measures are taken to adequately protect human health and the environment.

The CMS Work Plan (Dames & Moore, 2000) identified the following corrective measures alternative for the Stormwater Discharge Area:

SWMU 45	Corrective Measures Alternative
STORMWATER DISCHARGE AREA	**Land use restrictions** Impose restrictions to prevent residential development

Table 10-1 summarizes the risks to human health and the environment evaluated in the Phase II RFI (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997), and the corrective measures alternatives identified for SWMU 45 in the CMS Work Plan (Dames & Moore, 2000).

10.2 DETAILED EVALUATION OF CORRECTIVE MEASURES ALTERNATIVE

This corrective measures alternative involves the application of land use restrictions to ensure that the current land use (i.e., military) does not change to residential or other unauthorized use in the future. Alternative 1 includes no active corrective measures.

These restrictions would be incorporated into TEAD's master land use plan. This plan also calls for inspections and monitoring to ensure the restrictions are being observed. Because U.S. Army regulations direct that all revisions to this plan be evaluated with regard to potential impacts to human health and the environment, authorization for another (i.e., nonmilitary) use of SWMU 45 requires the resolution of conflicts between identified risks and hazards and proposed changes in land use at the site.

The real property planning board has authority over land use at the base, and is responsible for developing, enforcing, and modifying the installation's master land use plan. The authority of the board is derived from the responsible major Army command (i.e., OSC), which has specific oversight functions. These responsibilities include approving the installation's master land use plan and any proposed changes. Appendix C of the CMS Work Plan (Dames & Moore, 2000) presents a more detailed description of land use restrictions.

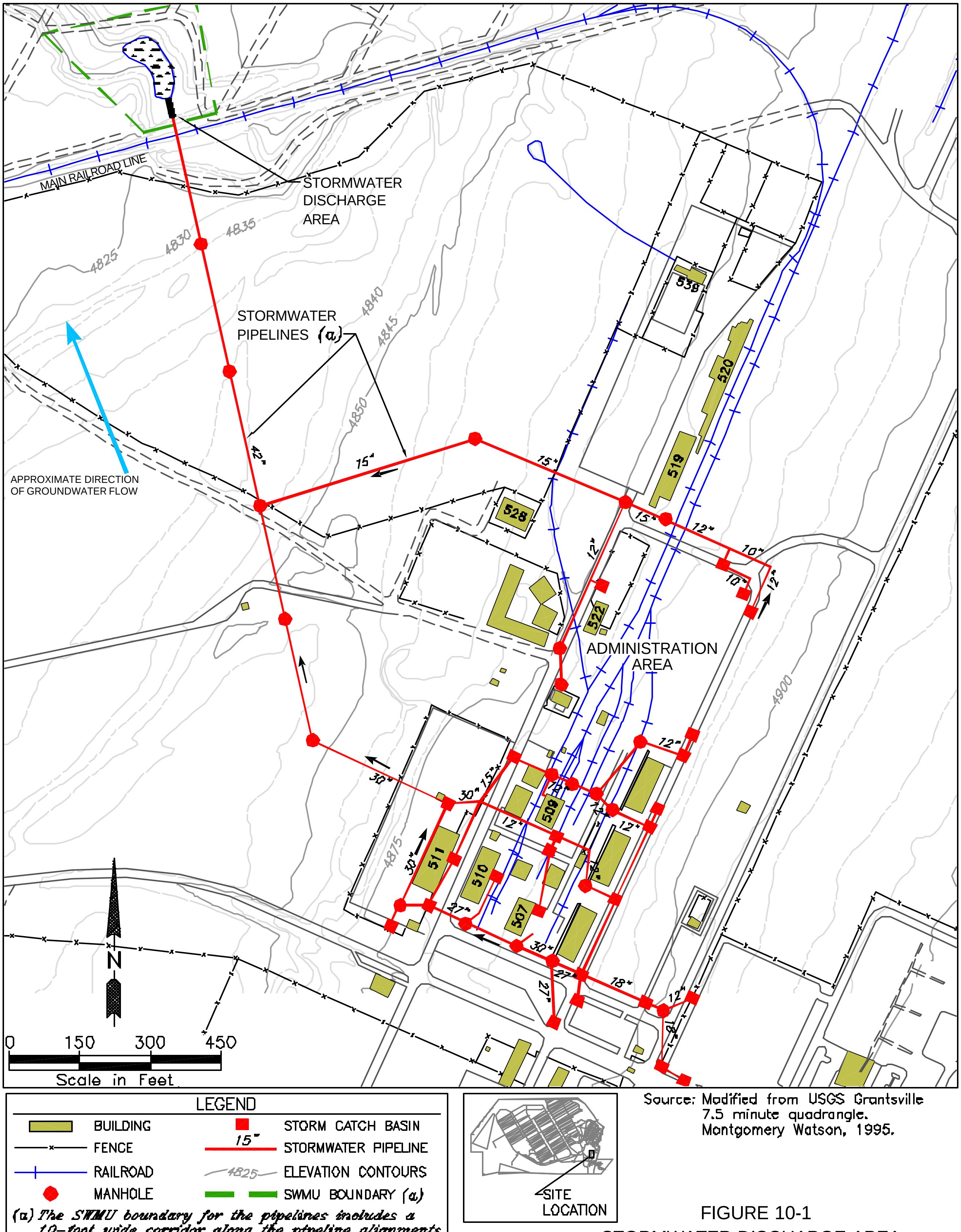


FIGURE 10-1
STORMWATER DISCHARGE AREA
(SWMU 45)
TOOELE ARMY DEPOT

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09604\056 File: FIG10-1.DWG Date/Time: May 25, 2000 1:01 p.m. Scale: 1=0 kdembin Xrefs:

TABLE 10-1

Summary of Phase II RFI, SWERA, and CMS Work Plan
Stormwater Discharge Area (SWMU 45)

Phase II RFI (Montgomery Watson, 1997)									SWERA (Rust E&I, 1997)	CMS Work Plan (Dames & Moore, 2000)	
Human Health Risk Assessment (a)								Impacts to Groundwater	Ecological Risk	COCs	Corrective Measures Alternative (b)
Hypothetical Future Residential Land Use Scenario (c)				Realistic Future Land Use Scenario (d)				None	Moderate (g)	None	***Land use restrictions***
	Risk	HI	Blood Lead Level (e)		Risk	HI	Blood Lead Level (e)				
Adult	**4×10^{-4}**	NE (f)	NE	Military	6×10^{-7}	0.008	NE				
Child	NE	**9**	**10.1**	Construction	3×10^{-6}	0.4	4				

(a) Risks, HIs, and blood lead levels that are above comparison levels appear in bold type.
(b) The selected corrective measures alternative appears in bold italic type.
(c) EPA guidance and UAC R315-101-5.2(b)(1) require evaluation of the hypothetical future land use scenario. Because risks and HIs are greater than 1×10^{-6} and 1.0, respectively, EPA guidance and UAC R315-101-6(c)(3) indicate that a CMS must be performed.
(d) EPA guidance and UAC R315-101-5.2(b)(2) require evaluation of the realistic future land use scenario. Because risks and HIs are less than 1×10^{-4} and 1.0, respectively, UAC R315-101-6(d) indicates that management measures and active corrective measures can be evaluated.
(e) Blood lead levels are expressed as micrograms per deciliter (µg/dL) for 95 percent of the population (should not exceed 10 µg/dL).
(f) NE = pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).
(g) The SWERA (Rust E&I, 1997) recommended no remedial measures to reduce ecological risk because it determined that remediation would damage valuable wildlife habitat.

Alternative 1 – land use restrictions – is evaluated as follows:

- <u>Technical evaluation</u>

  - <u>Performance</u> – Land use restrictions prevent future residential exposure to contaminants in soil, sediment, and surface water, and meet the CAOs developed in the CMS Work Plan (Dames & Moore, 2000). This corrective measures alternative is applicable to site characteristics and meets the identified CAOs with no decrease in effectiveness over time.

  - <u>Reliability</u> – Land use restrictions are effective over the long term and have been implemented at many sites with positive results. No additional exposure should occur while the restrictions are in place. No O&M, management of waste materials, or long-term environmental monitoring is required.

  - <u>Implementability</u> – Because SWMU 45 is currently under military use, continuing restrictions at this site should not be difficult.

  - <u>Safety</u> – No intrusive activities are required for implementation of this alternative.

- <u>Human health assessment</u> – Restricting future development of the site protects human health by preventing residential exposure to the previously identified contaminants in soil, sediment, and surface water at SWMU 45. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- <u>Environmental assessment</u> – Although this alternative does not reduce ecological risk, the ecological RA concluded that the ecological risk at SWMU 45 does not warrant corrective measures. The ecological RA also concluded that corrective measures, if performed, will damage valuable wildlife habitat.

- <u>Administrative feasibility</u> – Because SWMU 45 is to remain under U.S. Army control, land use restrictions will be administered through the installation's real property planning board. The implementation of land use restrictions at this site meets the specified requirements of UAC R315-101.

- <u>Cost</u> – The estimated cost of implementing this corrective measures alternative is $12,000. Table A-20 (see Appendix A) presents the detailed cost estimate.

10.3 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVE

Based on the above evaluation, Alternative 1 – land use restrictions – is recommended as the preferred alternative for SWMU 45 because:

- It meets the requirements of UAC R315-101.
- It has been demonstrated at other sites.
- It is reliable and implementable.

11.0 OLD DISPENSARY DISCHARGE - BUILDING 400 (SWMU 48)

Section 11.0 evaluates corrective measures alternatives for the Old Dispensary Discharge - Building 400 (SWMU 48; Figure 11-1). Data from the CMS Work Plan (Dames & Moore, 2000), the human health RA (Montgomery Watson, 1997), and the SWERA (Rust E&I, 1997) are also summarized below.

11.1 SUMMARY OF RAs AND CMS WORK PLAN

As shown on Figure 11-1, the Old Dispensary Discharge - Building 400 (SWMU 48) is located approximately 300 feet northwest of the present TEAD clinic, in the Administration Area. It is a flat, grass-covered area of approximately 8.2 acres. SWMU 48 was the site of the former TEAD dispensary (Building 400) and nine smaller buildings. The dispensary was constructed in 1945 and originally served as an administration building; it was later used as a hospital for TEAD (Montgomery Watson, 1997). Building 400 included operating rooms, a sterilization room, X-ray rooms, and a dental office; the development of X-rays may have generated contaminated waste.

Although plans for Building 400 indicate that waste streams from X-ray operations were discharged to the sanitary sewer system, there is a possibility that these or other wastes were disposed of into the adjacent stormwater lines. In the mid-1980s, the former dispensary and other buildings were razed to facilitate construction of the present clinic. Other improvements at SWMU 48 included an asphalt parking lot, and water, sewer, and stormwater lines.

The Phase II RFI (Montgomery Watson, 1997) identified unacceptable risks and hazards to human health at SWMU 48 under the hypothetical future residential land use scenario. Therefore, according to EPA guidance and UAC R315-101-6(c)(3), this SWMU is included in the CMS process, and corrective measures must be evaluated. However, the human health RA concluded that SWMU 48 presents no unacceptable risk to current Depot workers or future construction workers. In addition, because the assumed future land use is continued military use, there is no unacceptable risk under the realistic future land use scenario. Although the hypothetical future residential land use scenario presents unacceptable risks, the realistic future land use scenario presents no unacceptable risks; therefore, management measures are evaluated according to UAC R315-101-1(b)(4).

No groundwater monitoring was conducted at SWMU 48. However, according to the Phase II RFI (Montgomery Watson, 1997), the site constituents are not expected to affect groundwater based on the relatively low levels of contamination detected in the soil, low precipitation rates, high evaporation rates, and depth to groundwater (which is estimated to be over 400 feet bgs).

The SWERA (Rust E&I, 1997) indicated that the site poses a low ecological risk and recommended no corrective measures to reduce risk.

In summary, because the military land use scenario presents no unacceptable risks or hazards to either human health or the environment, management measures are evaluated as per UAC R315-101-1(b)(4). The CAO for SWMU 48 is to ensure that – if the future land use changes – appropriate measures are taken to adequately protect human health and the environment.

Based on the results of the human health and ecological RAs, and regulatory requirements, the CMS Work Plan (Dames & Moore, 2000) identified the following corrective measures alternative for SWMU 48:

SWMU 48	Corrective Measures Alternative
OLD DISPENSARY DISCHARGE – BUILDING 400	**Land use restrictions** Impose land use restrictions to prevent residential development

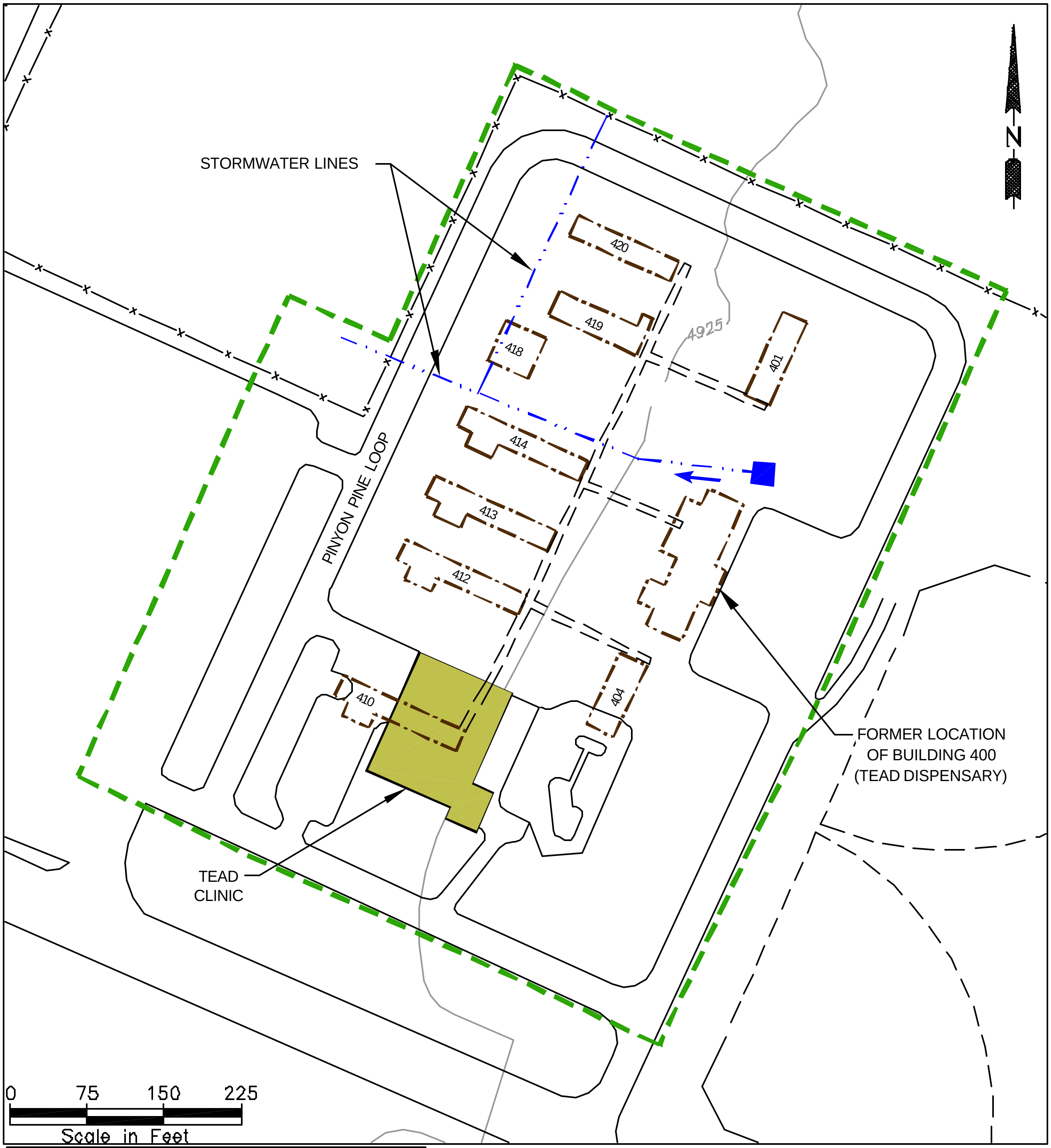
Table 11-1 summarizes the risks to human health and the environment evaluated in the Phase II RFI (Montgomery Watson, 1997) and the SWERA (Rust E&I, 1997), and the corrective measures alternatives identified for SWMU 48 in the CMS Work Plan (Dames & Moore, 2000).

11.2 DETAILED EVALUATION OF CORRECTIVE MEASURES ALTERNATIVE

This corrective measures alternative involves the application of land use restrictions to ensure that the current land use (i.e., military) does not change to residential or other unauthorized use in the future. Alternative 1 includes no active corrective measures.

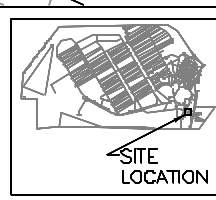
These restrictions would be incorporated into TEAD's master land use plan. This plan also calls inspections and monitoring to ensure the restrictions are being observed. Because U.S. Army regulations direct that all revisions to this plan be evaluated with regard to potential impacts to human health and the environment, authorization for another (i.e., nonmilitary) use of SWMU 48 requires the resolution of conflicts between identified risks and hazards and proposed changes in land use at the site.

The real property planning board has authority over land use at the base, and is responsible for developing, enforcing, and modifying the installation's master land use plan. The authority of the board is derived from the responsible major Army command (i.e., OSC), which has specific oversight functions. These responsibilities include approving the installation's master land use plan and any proposed changes. Appendix C of the CMS Work Plan (Dames & Moore, 2000) presents a more detailed description of land use restrictions.



LEGEND

- CONCRETE STORMWATER SYSTEM
- FLOW DIRECTION
- STORMWATER CATCH BASIN
- BUILDING
- FENCE
- FORMER LOCATION OF TEAD DISPENSARY AND ASSOCIATED BUILDINGS
- SWMU BOUNDARY (APPROX.)



Source: Modified from USGS Grantsville 7.5 minute quadrangle. Montgomery Watson, 1995.

FIGURE 11-1
OLD DISPENSARY DISCHARGE
BUILDING 400
(SWMU 48)
TOOELE ARMY DEPOT

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TABLE 11-1

Summary of Phase II RFI, SWERA, and CMS Work Plan
Old Dispensary Discharge - Building 400 (SWMU 48)

Phase II RFI (Montgomery Watson, 1997)										SWERA (Rust E&I, 1997)	CMS Work Plan (Dames & Moore, 2000)	
Human Health Risk Assessment (a)									**Impacts to Groundwater**	**Ecological Risk**	**COCs**	**Corrective Measures Alternative (b)**
Hypothetical Future Residential Land Use Scenario (c)				**Realistic Future Land Use Scenario (d)**					None	Low	None	***Land use restrictions***
	Risk	**HI**	**Blood Lead Level**		**Risk**	**HI**	**Blood Lead Level**					
Adult	**5×10^{-4}**	NE(e)	NE	Military	1×10^{-6}	0.05	NE					
Child	NE	**5**	NE	Construction	9×10^{-8}	0.04	NE					

(a) Risks, HIs, and blood lead levels that are above comparison levels appear in bold type.
(b) The selected corrective measures alternative appears in bold italic type.
(c) EPA guidance and UAC R315-101-5.2(b)(1) require evaluation of the hypothetical future land use scenario. Because risks and HIs are greater than 1×10^{-6} and 1.0, respectively, EPA guidance and UAC R315-101-6(c)(3) indicate that a CMS must be performed.
(d) EPA guidance and UAC R315-101-5.2(b)(2) require evaluation of the realistic future land use scenario. Because risks and HIs are less than 1×10^{-4} and 1.0, respectively, UAC R315-101-6(d) indicates that management measures and active corrective measures can be evaluated.
(e) NE = pathway incomplete or not evaluated; see CMS Work Plan (Dames & Moore, 2000).

Alternative 1 – land use restrictions – is evaluated as follows:

- Technical evaluation

  – Performance – Land use restrictions limit future exposure by preventing future residential development of the site. This corrective measures alternative is applicable to both site and contaminant characteristics, and meets the identified CAOs with no decrease in effectiveness over time.

  – Reliability – Land use restrictions are effective over the long term and have been implemented at many sites with positive results. No residential or other unauthorized exposure should occur while the restrictions are in place. No O&M, management of waste materials, or long-term environmental monitoring is required.

  – Implementability – Because SWMU 48 is currently under military use, continuing restrictions at this site should not be difficult.

  – Safety – No intrusive activities are required for implementation of this alternative.

- Human health assessment – Restricting future development of the site protects human health by preventing residential exposure to the previously identified contaminants in soil at SWMU 48. The residual risk remaining onsite for soil results from soil contamination at concentrations below military use CAOs but above residential use CAOs.

- Environmental assessment – The SWERA (Rust E&I, 1997) identified no adverse effects to ecological receptors as a result of the contaminants in soil at SWMU 48.

- Administrative feasibility – Because SWMU 48 is to remain under U.S. Army control, land use restrictions will be administered through the installation's real property planning board. The implementation of land use restrictions at this site meets the requirements of UAC R315-101.

- Cost – The estimated cost of implementing this corrective measures alternative is $12,000. Table A-21 (see Appendix A) presents the detailed cost estimate.

11.3 RECOMMENDED CORRECTIVE MEASURES ALTERNATIVE

Based on the above evaluation, Alternative 1 – land use restrictions – is recommended as the preferred alternative for SWMU 48 because:

- It meets the requirements of UAC R315-101.

- It has been demonstrated at other sites.
- It is reliable and implementable.

12.0 SUMMARY OF RECOMMENDED CORRECTIVE MEASURES ALTERNATIVES

Based on the evaluation of corrective measures alternatives, Section 12.0 lists the recommended alternatives for each of the SWMUs considered in this CMS. These recommendations are based on the evaluation criteria considered in the detailed analyses, as reported in Sections 3.0 through 11.0. Table 12-1 summarizes the evaluations conducted for SWMUs 1b, 1c, 20, 21, 34, 37, 42, 45, and 48.

12.1 SWMU 1b

Land use restrictions to prevent future residential development is the recommended corrective measures alternative for the Burn Pad.

12.2 SWMU 1c

Land use restrictions to prevent future residential development is the recommended corrective measures alternative for the Trash Burn Pits.

12.3 SWMU 20

Asphalt cover and land use restrictions is the recommended corrective measures alternative for the AED Deactivation Furnace Site.

12.4 SWMU 21

Asphalt cover and land use restrictions is the recommended corrective measures alternative for the Deactivation Furnace Building.

12.5 SWMU 34

Excavation, off-post treatment/disposal, and land use restrictions is the recommended corrective measures alternative for the Pesticide Handling and Storage Area.

12.6 SWMU 37

Land use restrictions to prevent future residential development is the recommended corrective measures alternative for the Contaminated Waste Processing Plant.

12.7 SWMU 42

Soil cover, fence, and land use restrictions is the recommended corrective measures alternative for the Bomb Washout Building.

TABLE 12-1

Summary of Comparative Analysis of Corrective Measures Alternatives
Group A Suspected Releases SWMUs
Tooele Army Depot

SWMU	Technical Evaluation							
Corrective Measures Alternative (a)	**Performance**	**Reliability**	**Implementability**	**Safety**	**Human Health Assessment**	**Environmental Assessment**	**Administrative Feasibility**	**Cost ($)**
SWMU 1B BURN PAD								
Land use restrictions	Meets all identified CAOs	No O&M or long-term monitoring required	Easily implemented under current conditions	Not of concern	Protective of human health	Environmental impacts identified as low	Meets requirements of UAC R315-101	12,000
SWMU 1C TRASH BURN PITS								
Land use restrictions	Meets all identified CAOs	No O&M or long-term monitoring required	Easily implemented under current conditions	Not of concern	Protective of human health	Environmental impacts identified as low	Meets requirements of UAC R315-101	12,000
SWMU 20 AED DEACTIVATION FURNACE SITE								
Alternative 1: Land use restrictions	Does not meet identified CAOs	No O&M or long-term monitoring required	Easily implemented under current conditions	Not of concern	Not protective of human health due to elevated blood lead level	Does not reduce ecological risk which is moderate but not unacceptable	Does not meet requirements of UAC R315-101 due to exceedance of CDC target for blood lead level	12,000
Alternative 2: Asphalt cover and land use restrictions	Meets all identified CAOs if cover is properly maintained	Proven effective at other sites; requires annual inspection and maintenance of asphalt cover	Easily implemented	Negligible short-term risk	Protective of human health	Further reduces ecological risk	Meets requirements of UAC R315-101	130,000
Alternative 3: Excavation, solidification/stabilization, and land use restrictions	Meets all identified CAOs, but pretreatment testing is required	Proven effective at other sites for meeting TCLP requirements, 5-year inspections recommended to confirm long-term effectiveness	Implementation by commercial contractors available, but number of experienced vendors may be limited	Low short-term risk to workers	Protective of human health	Further reduces ecological risk	Meets requirements of UAC R315-101; may require RCRA permit	270,000
Alternative 4: Excavation, soil washing, and land use restrictions	Meets all identified CAOs, but pretreatment testing is required	Proven effective at other sites; requires no O&M or long-term monitoring	Implementation by commercial contractors available, but number of experienced vendors may be limited	Moderate short-term risk to off-post residential communities and workers	Protective of human health	Further reduces ecological risk	Meets requirements of UAC 315-101; may require RCRA permit	280,000
Alternative 5: Excavation, off-post treatment/ disposal, and land use restrictions	Meets all identified CAOs	Proven effective at other sites; requires no O&M or long-term monitoring onsite; these activities are required at off-post landfill	Implementation by commercial contractors readily available; Subtitle C landfill and TSDF within 100 miles	Moderate short-term risk to off-post residential communities and workers	Protective of human health	Further reduces ecological risk	Meets requirements of UAC R315-101	200,000

TABLE 12-1 (cont'd)

SWMU	Technical Evaluation							
Corrective Measures Alternative (a)	**Performance**	**Reliability**	**Implementability**	**Safety**	**Human Health Assessment**	**Environmental Assessment**	**Administrative Feasibility**	**Cost ($)**
SWMU 21 DEACTIVATION FURNACE BUILDING								
Alternative 1: Asphalt cover and land use restrictions	Meets all identified CAOs if cover is properly maintained	Proven effective at other sites; requires annual inspection and maintenance of asphalt cover	Easily implemented	Negligible short-term risk	Protective of human health	Reduces ecological risk to acceptable levels	Meets requirements of UAC R315-101	230,000
Alternative 2: Excavation, solidification/stabilization, and land use restrictions	Meets all identified CAOs, but pretreatment testing is required	Proven effective at other sites for meeting TCLP requirements; requires 5-year inspections to confirm long-term effectiveness	Implementation by commercial contractors available, but number of experienced vendors may be limited	Low short-term risk to workers	Protective of human health	Reduces ecological risk to acceptable levels	Meets requirements of UAC R315-101; may require RCRA permit, disrupts furnace operations	480,000
Alternative 3: Excavation, soil washing, and land use restrictions	Meets all identified CAOs, but pretreatment testing is required	Proven effective at other sites; requires no O&M or long-term monitoring	Implementation by commercial contractors available, but number of experienced vendors may be limited	Moderate short-term risk to off-post residential communities and workers	Protective of human health	Reduces ecological risk to acceptable levels	Meets requirements of UAC 315-101; may require RCRA permit, disrupts furnace operations	550,000
Alternative 4: Excavation, off-post treatment/ disposal, and land use restrictions	Meets all identified CAOs	Proven effective at other sites; requires no O&M or long-term monitoring onsite; these activities are required at off-post landfill	Implementation by commercial contractors readily available; Subtitle C landfill and TSDF within 100 miles	Moderate short-term risk to off-post residential communities and workers	Protective of human health	Reduces ecological risk to acceptable levels	Meets requirements of UAC R315-101, disrupts furnace operations	560,000
SWMU 34 PESTICIDE HANDLING AND STORAGE AREA								
Alternative 1: Land use restrictions	Does not meet identified CAOs	No O&M or long-term monitoring required	Easily implemented under current conditions	Not of concern	Not protective of Depot worker human health	Environmental impacts identified as low	Does not meet requirements of UAC R315-101-3 because COCs can migrate to other media	12,000
Alternative 2: Soil cover, fence, and land use restrictions	Meets all identified CAOs if cover is properly maintained	Proven effective at other sites; requires annual inspection and maintenance of soil cover and fence	Easily implemented	Negligible short-term risk	Protective of human health	Environmental impacts identified as low, further reduces risk	Meets requirements of UAC R315-101	43,000
Alternative 3: Excavation, off-post treatment/disposal, and land use restrictions	Meets all identified CAOs	Proven effective at other sites; requires no O&M or long-term monitoring onsite; these activities are required at off-post landfill	Implementation by commercial contractors readily available; Subtitle C landfill and TSDF within 100 miles	Low short-term risk to off-post residential communities and workers	Protective of human health	Environmental impacts identified as low, further reduces risk	Meets requirements of UAC R315-101	63,000

TABLE 12-1 (cont'd)

SWMU	Technical Evaluation							
Corrective Measures Alternative (a)	**Performance**	**Reliability**	**Implementability**	**Safety**	**Human Health Assessment**	**Environmental Assessment**	**Administrative Feasibility**	**Cost ($)**
SWMU 37 CONTAMINATED WASTE PROCESSING PLANT								
Land use restrictions	Meets all identified CAOs	Requires no O&M or long-term monitoring	Easily implemented under current conditions	Not of concern	Protective of human health	Environmental impacts identified as moderate but not unacceptable	Meets requirements of UAC R315-101	12,000
SWMU 42 BOMB WASHOUT BUILDING								
Alternative 1: Soil cover, fence, and land use restrictions	Meets all identified CAOs if cover is properly maintained	Proven effective at other sites; requires annual inspection and maintenance of soil cover and fence	Easily implemented	Low short-term risk to workers, UXO concerns	Protective of human health	Reduces ecological risk to acceptable levels	Meets requirements of UAC R315-101	520,000
Alternative 2: Excavation, solidification/stabilization, and land use restrictions	Meets all identified CAOs, but pretreatment testing is required	Proven effective at other sites for meeting TCLP requirements, requires 5-year inspections to confirm long-term effectiveness	Implementation by commercial contractors available, but number of experienced vendors may be limited	Low short-term risk to workers, UXO concerns	Protective of human health	Reduces ecological risk to acceptable levels	Meets requirements of UAC R315-101; may require RCRA permit	1,280,000
Alternative 3: Excavation, soil washing, and land use restrictions	Meets all identified CAOs, but pretreatment testing is required	Proven effective at other sites; requires no O&M or long-term monitoring	Implementation by commercial contractors available, but number of experienced vendors may be limited	Moderate short-term risk to off-post residential communities and workers, UXO concerns	Protective of human health	Reduces ecological risk to acceptable levels	Meets requirements of UAC 315-101; may require RCRA permit	1,630,000
Alternative 4: Excavation, off-post treatment/ disposal, and land use restrictions	Meets all identified CAOs	Proven effective at other sites; requires no O&M or long-term monitoring onsite; these activities are required at off-post landfill	Implementation by commercial contractors readily available; Subtitle C landfill and TSDF within 100 miles	Moderate short-term risk to off-post residential communities and workers, UXO concerns	Protective of human health	Reduces ecological risk to acceptable levels	Meets requirements of UAC R315-101	2,120,000
SWMU 45 STORMWATER DISCHARGE AREA								
Land use restrictions	Meets all identified CAOs	Requires no O&M or long-term monitoring	Easily implemented under current conditions	Not of concern	Protective of human health	Environmental impacts identified as moderate but not unacceptable	Meets requirements of UAC 315-101	12,000
SWMU 48 OLD DISPENSARY DISCHARGE – BUILDING 400								
Land use restrictions	Meets all identified CAOs	Requires no O&M or long-term monitoring	Easily implemented under current conditions	Not of concern	Protective of human health	Environmental impacts identified as low	Meets requirements of UAC R315-101	12,000

(a) The preferred corrective measures alternative for each SWMU is shown in bold italic type.

12.8 SWMU 45

Land use restrictions to prevent future residential development is the recommended corrective measures alternative for the Stormwater Discharge Area.

12.9 SWMU 48

Land use restrictions to prevent future residential development is the recommended corrective measures alternative for the Old Dispensary Discharge - Building 400.

13.0 REFERENCES

Berti, W. R., et al., 1997. "In-Place Inactivation of Lead in Pb-Contaminated Soils," *Environmental Science & Technology*, Vol. 31, pp. 1359-1364.

Berti, W. R., et al., 1997. "Sequential Chemical Extraction of Trace Elements: Development and Use in Remediating Contaminated Soils," *Proceedings of the Third International Conference on the Biogeochemistry of Trace Elements*.

Camp, Dresser, McKee (CDM), 1985. *Performance of Remedial Response Activities at Uncontrolled Hazardous Waste Sites, Final Plan*, March 1985.

Crist and McIntyre, 1993. Personal interview, David L. Shank and D. Krupicka, of Montgomery Watson, with former Ammunition Engineering Directorate Director Frank Crist and employee Bernie McIntyre, May 3, 1993.

Dames & Moore, 2000. *Corrective Measures Study Work Plan, Group A Suspected Releases SWMUs, Tooele Army Depot, Tooele Utah*, Contract No. DACA31-94-D-0060, June 2000.

Doolan, Martin, 1998. Personal communication, Dr. Leonard Breitstein, Dames & Moore, with Martin Doolan, EPA, January 20, 1998.

Earth Technology Corporation, 1982. *Assessment of Environmental Contamination Exploratory Stage, Tooele Army Depot, Tooele, Utah, Volumes I - IV*, October 1982; 1986 addendum completed by EMSL, Las Vegas.

Federal Remediation Technologies Roundtable (FRTR), 1994. *Remediation Technologies Screening Matrix and Reference Guide*, October 1994.

Inland Pacific Engineering Company, 1982. *Installation Assessment*, June 1982.

James M. Montgomery Consulting Engineers (JMM), 1992. *Final Data Collection Quality Assurance Plan for Suspected Release RFI Phase I Study, Tooele Army Depot - North Area*, prepared for U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland.

JMM, 1988. *Final Groundwater Quality Assessment Engineering Report to the Tooele Army Depot, Utah*, prepared for U.S. Army Corps of Engineers, Huntsville, Alabama, Project No. 15870621, December 1988.

Jordan, 1989. Site visit walkover and interviews - Tooele Army Depot, North Area, requested by U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland, October 31 - November 2, 1989.

Laperche, V., et al., 1997. “Effects of Apatite Amendments on Plant Uptake of Lead From Contaminated Soil,” *Environmental Science & Technology*, Vol. 31, pp. 2745-2533.

Matso, K., 1995. “Mother Nature’s Pump and Treat,” *Civil Engineering*, October 1995.

McPheeters, C., 1998. Personal communication, Dr. Leonard Breitstein, Dames & Moore, with C. McPheeters, Sevenson Environmental Services Company, January 28, 1998.

Montgomery Watson Consulting Engineers, 1997. *Tooele Army Depot - North Area Group A Suspected Releases SWMUs - Phase II RFI Report*, prepared for U.S. Army Environmental Center (USAEC), Aberdeen Proving Ground, Maryland.

Montgomery Watson Consulting Engineers, 1993. *Final Phase I, RFI Report, Tooele Army Depot - North Area Suspected Releases SWMUs*, DAAA15-90-D-0011, prepared for USAEC, Aberdeen Proving Ground, Maryland, December 1993.

NUS, 1987. *Draft Interim RCRA Facility Assessment*, prepared for U.S. Environmental Protection Agency, Contract No. 68-01-7310, July 1987.

Radkiewicz, R.J., 1995. Memorandum on Command Policy on Establishing Remediation Goals and Objectives at U.S. Army Industrial Operations Command (IOC) Installations, U.S. Department of the Army, Headquarters, IOC, October 10, 1995.

Rhea, K., 1990. Telephone interview conducted by J. Mackinnon, Environmental Engineer, E.C. Jordan Co. with K. Rhea, TEAD-N employee, July 26, 1990.

Ruby, M. V., et al., 1996. “Estimation of Lead and Arsenic Bioavailability using Physiologically Based Extraction Test,” *Environmental Science & Technology*, Vol. 28, pp. 646-654.

Ruby, M. V., et al., 1994. “In Situ Formation of Lead Phosphates in Soils as a Method to Immobilize Lead,” *Environmental Science & Technology*, Vol. 28, pp. 646-654.

Rust E&I, 1997. *Tooele Army Depot - North Area Final Site-Wide Ecological Risk Assessment*, prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland.

Rust, E&I, 1995. *Revised Final Phase II RFI Report for Known Releases SWMUs, Tooele Army Depot - North Area*, prepared for U.S. Army Environmental Center, Aberdeen Ground, Maryland.

Sellstone, C. M., et al., 1996. "Reduction of Risk Through In Situ Amendment of Leaded Soils" (handout), *11th Annual Conference on Contaminated Soils, University of Massachusetts, October 1996*.

Sperber, Marc N., 1996. *RCRA Corrective Action Manual, Volume I*, Thompson Publishing Group, March 1996.

TEAD-N Facilities Engineering, 1983. *Analysis of Existing Facilities/Environmental Assessment Report*, prepared by TEAD-N Facilities Engineering, May 1983.

TEAD-N Facilities Engineering, 1985. *Analytical/Environmental Assessment Report*, prepared by TEAD-N Facilities Engineering, November 1985.

Tooele County Economic Development Corporation, 1995. *TEAD Conversion and Reuse Plan*.

U.S. Army Environmental Hygiene Agency (USAEHA), 1993. *Hazardous Waste Study No. 37-26-J1DY-93, Removal Action Assessment Tooele Army Depot, Tooele, Utah, May 3-7, 1993,* Aberdeen Proving Ground, Maryland.

USAEHA, 1985. *Phase 4 - Hazardous Waste Study No. 37-26-0462-85, AMC Open Burning/Open Detonation Grounds Evaluation, Investigation of Soil Contamination at the Open Burning Ground, Tooele Army Depot, Utah, 27 July - 10 August 1984*, Aberdeen Proving Ground, Maryland.

USAEHA, 1984. *Phase 3 - Hazardous Waste Special Study No. 39-26-0147-83, DARCOM Open Burning/Open Detonation Grounds Evaluation, November 1981 - September 1983,* Aberdeen Proving Ground, Maryland.

USAEHA, 1983. *Phase 2 - Hazardous Waste Special Study No. 39-26-0147-83, DARCOM Open Burning/Open Detonation Grounds Evaluation, Tooele Army Depot, Utah,* Aberdeen Proving Ground, Maryland.

USAEHA, 1982. *Final Report, Hazardous Waste Management Special Study No. 80-26-0207-83, Tooele Army Depot, Tooele, Utah, March 15 - September 26, 1982,* Aberdeen Proving Ground, Maryland.

U.S. Army Environmental Center (USAEC), 1994. *Remediation Technologies Screening Matrix and Reference Guide*, 2nd edition, EPA/542/B-94/013, NTIS PB95-104782, prepared by U.S. Department of Defense Environmental Technology Transfer Committee, October 1994.

U.S. Army Science Board, 1995. *Remediation of Contaminated Army Sites: Utility of Natural Attenuation*, Draft, April 1995.

U.S. Army Toxic and Hazardous Materials Agency, (USATHAMA) 1979. *Environmental Assessment of Tooele Army Depot*, Report No. 141, prepared for U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Maryland, December 1979.

U.S. Department of the Army, 1985. *A Study of Environmental Balance*.

U.S. Environmental Protection Agency (USEPA), 1994. EPA Region III Risk - Based Concentration Table, Third Quarter 1994, July 1994.

USEPA, 1991. *Risk Assessment Guidance for Superfund – Volume I, Human Health Evaluation Manual (Part B), Development of Risk-Based Preliminary Remediation Goals (Interim)*, PB92-963333, Office of Emergency and Remedial Response, Washington, D.C.

USEPA, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, OSWER Directive 9335.3-01, Office of Solid Waste and Emergency Response, Washington, D.C.

USEPA and EPIC, 1986. *Environmental Photographic Interpretation Center Report Addendum, Installation Assessment Report, Tooele Army Depot - North Area, Utah*, July 1986.

Yost, K. W., et al., 1994. "Lead and Other Heavy Metal Fixation in Soils and Solid Waste by the MAECTITE Chemical Treatment Process," *49th Annual Purdue Industrial Waste Conference*, May 10, 1994.

APPENDIX A

Cost Estimates
for
Corrective Measures Alternatives

APPENDIX A

Cost Estimates for Corrective Measures Alternatives

Sections A.1 through A.4 discuss the assumptions used in developing cost estimates for the corrective measures alternatives evaluated in the CMS Report. Section A.5 presents the cost estimates for each alternative. These cost estimates are anticipated to provide an accuracy of +50 to -30 percent based on available data and best engineering judgment.

A.1 DIRECT CAPITAL COST ASSUMPTIONS

A.1.1 Land Use Restrictions

- Includes a site management plan, survey, and legal description of the site.
- Includes administrative costs associated with obtaining land use restrictions from the Army.
- Includes site inspections to ensure land use restrictions are being observed.

A.1.2 Fencing

- Includes labor, materials, and equipment necessary for the construction of a fence to restrict access to the site. Assumes use of a 6-foot-high chainlink fence, and includes support posts, corner posts, and a locking gate. Cost is based on dollars per linear foot.
- Includes labor, materials, and equipment necessary for the installation of warning signs and placards along the perimeter fence.

A.1.3 Soil Operations Activities

A.1.3.1 Mobilization/Demobilization

- Includes costs associated with mobilization and demobilization for soil operations activities. Cost is significantly higher for on-site treatment technologies (i.e., soil washing) which require extensive equipment.

A.1.3.2 Ground Preparation/Clearing

- Includes equipment and labor necessary for clearing site vegetation as needed prior to remedial activities.

A.1.3.3 Soil Excavation

- Includes labor and equipment necessary for excavation of contaminated soil from the site to a nearby staging area for treatment or disposal. TCLP sampling will be conducted from soil staging area. Depth of excavation, which varies, is considered in the cost for each site. In general, the shallow excavation depths discussed in the CMS do not require special safety measures, such as shoring or access control.

- Includes costs for water tank rental and personnel to wet exposed soil areas to minimize dust during excavation/backfilling.

A.1.3.4 Temporary Erosion Control

- Includes labor, materials, and equipment necessary for temporary runon and runoff control as a means of erosion control during remedial activities. Does not include permanent erosion control measures, such as revegetation, which is included under a separate line item.

A.1.3.5 Backfilling

- Includes costs associated with hauling free backfill from on post (distance less than 6 miles), backfilling of excavated areas, and compaction, as necessary. Unit costs for backfill are increased to account for the increased costs associated with the uncompacted soil volumes.

A.1.3.6 Grading

- Includes equipment and labor needed for grading the surface of the site subsequent to remedial activities to minimize ponding and erosion.

A.1.3.7 Soil Cover

- Includes labor, materials, and equipment for the placement of a soil cover over contaminated areas at the site. The surface cover consists of 1 foot of soil from an on-post borrow area and PVC liner at selected sites. Costs for compaction to prevent settling are included, as necessary.

A.1.3.8 Revegetation/Seeding

- Includes labor, materials, and equipment for vegetation/seeding. Assumes that the site is previously cleared, major landscaping is not required, indigenous vegetation is planted, and soil is amended as necessary.

A.1.3.9 Asphalt Cover

- Includes labor, materials, and equipment for the placement of an asphalt cover over contaminated areas at a site. The cover consists of a liner at selected sites, a 9-inch gravel base course and a 3-inch bituminous asphalt layer.

A.1.4 Chemical Analyses

A.1.4.1 Confirmation Sampling

- Includes labor, materials, and laboratory fees associated with collection, shipment, and chemical analysis of surface and subsurface soil samples.

- Assumes that two personnel conduct sampling. Number of samples collected is estimated as 10 percent of the cubic yards of soil excavated or treated.

A.1.4.2 Soil Profile and Analytical Costs

- Includes costs associated with conducting a soil profile and soil analysis, which are required prior to off-post landfill disposal. Labor, equipment, shipment, and laboratory analysis are included. Number of samples is estimated as 1 percent of the cubic yards of soil excavated or treated.

A.1.4.3 Residual Profile and Analytical Costs

- Includes costs associated with conducting a treatment residuals profile and analysis, which are required prior to off-post landfill disposal. Labor, equipment, shipment, and laboratory analysis are included.

A.1.5 Treatment

A.1.5.1 Soil Washing Pretreatment Testing

- Includes labor, materials, and equipment to perform pretreatment testing to evaluate the effectiveness, cost, and optimum design parameters of a full-scale soil washing system.

A.1.5.2 Full-Scale Soil Washing

- Includes labor, materials, and equipment for treatment of contaminated soil with an appropriate soil washing technology; and associated cost of treatment of aqueous waste solution generated during the soil washing process. Treated wash water is assumed to be reused during operation of the soil washing system. At the end of the project, the final wash water will be treated and disposed of as necessary.

A.1.5.3 Solidification/Stabilization Pretreatment Testing

- Includes labor, materials, and equipment to perform pretreatment testing to evaluate the effectiveness, cost, and optimum design parameters of a full-scale solidification/stabilization system.

A.1.5.4 Full-Scale Solidification/Stabilization

- Includes labor, materials, and equipment for treatment of soil using an appropriate solidification/stabilization technology.

A.1.5.5 Mobilization/Demobilization

- Includes costs associated with establishing a working treatment system on-site, including transportation of equipment to the site, connection to utilities, setup of treatment train, mobile laboratory, decontamination facilities, and test run to verify operation. Assumes that required utilities are available, and no additional construction is needed to level the site other than building a treatment pad and stockpile area.

- Includes costs associated with removing the treatment system from the site, including breakdown and decontamination of equipment, transportation of equipment offsite, and restoration of areas occupied by the treatment system and appurtenances. Does not include regrading and revegetation of treated soil, which are included under separate line items.

A.1.5.6 Treatment Pad and Stockpile Area

- Includes labor, materials, and equipment necessary to erect an asphalt or concrete slab with a temporary building, sumps, sump pumps, decontamination pad, and stockpile storage area.

A.1.6 Disposal

A.1.6.1 Transportation to Landfill

- Includes costs associated with transportation of waste from the site to an off-post disposal facility within 100 miles of TEAD (i.e., Grassy Mountain). Use of appropriately permitted commercial transportation vendors is assumed.

A.1.6.2 Landfill Disposal

- Includes costs associated with off-post disposal at an appropriate disposal facility and other treatment methods required prior to landfilling, if applicable. Results of confirmation sampling and soil profiling are used to make the final determination concerning appropriate destinations for excavated material (TSDF, Subtitle C landfill or Subtitle D landfill). The type of disposal facility which can accept the excavated material is based on a preliminary review of site contaminants and potential waste processes contributing to contamination at each SWMU. Assumed disposal costs may change significantly if the final disposal determination differs from that assumed in the CMS report.

A.1.6.3 Transportation and Placement of Solidified/Stabilized Soil at SWMU 12/15

- Includes costs associated with transportation of wastes from the site to a CAMU within SWMU 12/15 (Known Releases).

- Includes costs of covering solidified/stabilized soil with a soil cover.

A.1.7 Unexploded Ordnance (UXO)

- Includes location, excavation, and potentially the removal of UXO. Assumes that UXO-trained personnel and explosive ordnance disposal (EOD) technicians are used, and that low-to-moderate levels of ordnance are present. It is assumed that TEAD will dispose of UXO.

- Includes UXO clearance at a cost of approximately $10 per square yard of disturbed surface area.

A.2 O&M DIRECT COST ASSUMPTIONS

A.2.1 Annual Inspection/Maintenance

- Includes labor, materials, and equipment for annual inspection/maintenance to ensure the long-term reliability of the soil cover, paved surface, and fences.

- Assumes annual O&M cost at 10 to 15 percent of the direct capital cost of construction, exclusive of the cost of land use restrictions and UXO clearance.

A.2.2 Five-Year Inspections for Solidified/Stabilized Soil

- Includes 5-year inspections to confirm the long-term effectiveness of the solidification/stabilization process. Includes costs to conduct TCLP tests and to prepare letter reports.

A.3 INDIRECT CAPITAL COST ASSUMPTIONS

A.3.1 Engineering and Construction Management

- Includes technical engineering support during the design and construction phases of various remedial activities at 20 percent of total direct costs.

A.3.2 Health and Safety Equipment and Training

- Includes health and safety equipment and training during remediation activities at 5 percent of total direct costs.

A.3.3 Legal and Administrative

- Includes costs associated with legal and administrative issues related to implementation of the remedial action – such as coordination with Federal, State, and local agencies; landowners; and other authorities – at 5 percent of total direct costs.

A.3.4 Project Management

- Includes technical direction, quality control, monthly progress reports, and invoice generation for the project at 5 to 10 percent of total direct costs, depending on the types of activities and technologies involved in a corrective measures alternative.

A.4 OTHER COST ESTIMATING ASSUMPTIONS

The following are other general assumptions for the development of cost estimates.

- The volume of soil after excavation (i.e., no longer compacted) is 25 percent greater than the in-place volume.

- Each cubic yard of excavated soil weighs approximately 1.4 tons (based on density of 1.66 grams per cubic centimeter (g/cm^3)).

- The amount of residual soil fines to be landfilled after soil washing is 15 percent of weight of washed soil.

- Each load of soil to be transported to an off-post landfill weighs 20 tons.

- For present worth calculations, the discount rate is 7 percent based on EPA's Office of Solid Waste and Emergency Response (OSWER) Directive No. 9355.3-20.

- O&M activities, including 5-year inspections for the solidification/ stabilization process, are conducted for 30 years.

- The contingency cost is 20 percent of the cost of the alternative.

A.5 DETAILED COST ESTIMATES

Tables A-1 to A-21 summarize cost estimates for the corrective measures alternatives considered for the Group A SWMUs.

Table A-1: SWMU 1b - Alternative 1: *Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Subtotal Direct Capital Costs				5,000
Indirect Capital Costs				
Administrative (5% of direct costs)				250
Project Management (10% of direct costs)				500
Subtotal Indirect Capital Costs				800
Total Capital Costs				5,800
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				9,800
Contingency (@ 20%)				1,960
Total Cost of Alternative				12,000

Key to unit abbreviations	
ls	lump sum

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-2: SWMU 1c - Alternative 1: *Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Subtotal Direct Capital Costs				5,000
Indirect Capital Costs				
Administrative (5% of direct costs)				250
Project Management (10% of direct costs)				500
Subtotal Indirect Capital Costs				800
Total Capital Costs				5,800
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				9,800
Contingency (@ 20%)				1,960
Total Cost of Alternative				12,000

Key to unit abbreviations	
ls	lump sum

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-3: SWMU 20 - Alternative 1: *Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Subtotal Direct Capital Costs				5,000
Indirect Capital Costs				
Administrative (5% of direct costs)				250
Project Management (10% of direct costs)				500
Subtotal Indirect Capital Costs				800
Total Capital Costs				5,800
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				9,800
Contingency (@ 20%)				1,960
Total Cost of Alternative				12,000

Key to unit abbreviations	
ls	lump sum

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-4: SWMU 20 - Alternative 2: *Asphalt Cover and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Mobilization/demobilization	1	ls	5,000.00	5,000
UXO Clearance	800	sy	10.00	8,000
Ground Preparation/Clearing	800	sy	0.20	200
Stabilization geotextile	800	sy	3.00	2,400
Gravel Base Course (9 inch)	800	sy	10.60	8,500
Bituminous Asphalt Cover (3 inch)	800	sy	8.00	6,400
Subtotal Direct Capital Costs				35,500
Indirect Capital Costs				
Engineering and Construction Management (30% of direct costs)				10,700
Health and Safety Equipment & Training (5% of direct costs)				1,800
Legal and Administrative (5% of direct costs)				1,800
Project Management (20% of direct costs)				7,100
Subtotal Indirect Capital Costs				21,400
Total Capital Costs				56,900
O&M Costs				
Annual Inspection and Maintenance	10% of direct capital construction costs			3,550
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				3,850
Present Worth O&M Costs (30 years @ 7% Discount Rate)				51,200
Subtotal Cost of Alternative				108,100
Contingency (@ 20%)				21,620
Total Cost of Alternative				130,000

Key to unit abbreviations	
ls	lump sum
sy	square yard

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-5: SWMU 20 - Alternative 3: *Excavation, Solidification/Stabilization, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
UXO Clearance	800	sy	10.00	8,000
Stabilization Pretreatment Testing	1	ls	30,000.00	30,000
Mobilization/Demobilization	1	ls	30,000.00	30,000
Ground Preparation/Clearing	800	sy	0.20	200
Soil Excavation	270	cy	20.00	5,400
Backfilling	270	cy	10.00	2,700
Confirmation Sampling	27	sample	175.00	4,800
Treatment Pad and Stockpile Area	1	ls	10,000.00	10,000
Transport to SWMU 12/15	270	cy	10.00	2,700
Soil Cover at SWMU 12/15	70	cy	10.00	700
Soil Profile and Analytical Costs	3	sample	1,300.00	3,900
Solidification/Stabilization	380	ton	75.00	28,500
Grading	8	msf	48.00	400
Revegetation/Seeding	800	sy	0.22	200
Subtotal Direct Capital Costs				132,500
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				26,500
Health and Safety Equipment & Training (5% of direct costs)				6,700
Legal and Administrative (5% of direct costs)				6,700
Project Management (10% of direct costs)				13,300
Subtotal Indirect Capital Costs				53,200
Total Capital Costs				185,700
O&M Costs				
Five Year Site Inspection for stabilized soil	1	each	15,000	15,000
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Present Worth O&M Costs (30 years @ 7% Discount Rate)				36,340
Subtotal Cost of Alternative				222,040
Contingency (@ 20%)				44,408
Total Cost of Alternative				270,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-6: SWMU 20 - Alternative 4: *Excavation, Soil Washing, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
UXO Clearance	800	sy	10.00	8,000
Soil Washing Pretreatment Testing	1	ls	30,000.00	30,000
Mobilization/Demobilization	1	ls	40,000.00	40,000
Ground Preparation/Clearing	800	sy	0.20	200
Treatment Pad and Stockpile Area	1	ls	10,000.00	10,000
Soil Excavation	270	cy	20.00	5,400
Backfilling	270	cy	8.00	2,200
Soil Washing (2)	380	ton	100.00	38,000
Confirmation Sampling	27	sample	175.00	4,800
Soils Profile and Analytical Costs	3	sample	1,300.00	3,900
Transport to TSDF/Landfill	40	cy	70.00	2,800
TSDF/Subtitle C Landfill Disposal Cost	60	ton	150.00	9,000
Grading	8	msf	48.00	400
Revegetation/Seeding	800	sy	0.22	200
Subtotal Direct Capital Costs				159,900
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				32,000
Health and Safety Equipment & Training (5% of direct costs)				8,000
Legal and Administrative (5% of direct costs)				8,000
Project Management (10% of direct costs)				16,000
Subtotal Indirect Capital Costs				64,000
Total Capital Costs				223,900
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (3)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				227,900
Contingency (@ 20%)				45,580
Total Cost of Alternative				280,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) If acid leaching is required in the soil washing process (as determined by the treatibility study) the cost of treatment will be increased to approximately $200 per ton
(3) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-7: SWMU 20 - Alternative 5: *Excavation, Off-Post Treatment/Disposal, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Mobilization/demobilization	1	ls	5,000.00	5,000
UXO Clearance	800	sy	10.00	8,000
Ground Preparation/Clearing	800	sy	0.20	200
Soil Excavation	270	cy	20.00	5,400
Backfilling Clean Soil	270	cy	10.00	2,700
Confirmation Sampling	27	sample	175.00	4,800
Soil Profile and Analytical Costs	3	sample	1,300.00	3,900
Transport to TSDF/Landfill	270	cy	70.00	18,900
TSDF/Subtitle C Landfill Disposal Cost	380	ton	150.00	57,000
Grading	8	msf	48.00	400
Revegetation/Seeding	800	sy	0.22	200
Subtotal Direct Capital Costs				111,500
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				22,300
Health and Safety Equipment & Training (5% of direct costs)				5,600
Legal and Administrative (5% of direct costs)				5,600
Project Management (10% of direct costs)				11,200
Subtotal Indirect Capital Costs				44,700
Total Capital Costs				156,200
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				160,200
Contingency (@ 20%)				32,040
Total Cost of Alternative				200,000

Key to unit abbreviations	
cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-8: SWMU 21 - Alternative 1: *Asphalt Cover and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs (1)				
Land Use Restrictions (2)	1	ls	5,000.00	5,000
Mobilization/demobilization	1	ls	10,000.00	10,000
UXO Clearance	1,455	sy	10.00	14,600
Ground Preparation/Clearing	1,455	sy	0.20	300
Stabilization geotextile	1,455	sy	3.00	4,400
Gravel Base Course (9 inch) (3)	1,000	sy	10.60	10,600
PVC Liner	1,455	sy	7.00	10,200
Bituminous Asphalt Cover (3 inch)	1,455	sy	8.00	11,700
Subtotal Direct Capital Costs				66,800
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				13,400
Health and Safety Equipment & Training (5% of direct costs)				3,400
Legal and Administrative (5% of direct costs)				3,400
Project Management (10% of direct costs)				6,700
Subtotal Indirect Capital Costs				26,900
Total Capital Costs				93,700
O&M Costs				
Annual Inspection and Maintenance	10% of direct capital costs (4)			6,680
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (5)	1	each	0	0
Subtotal O&M Costs				7,000
Present Worth O&M Costs (30 years @ 7% Discount Rate)				93,000
Subtotal Cost of Alternative				186,700
Contingency (@ 20%)				37,340
Total Cost of Alternative				230,000

Key to unit abbreviations

ls	lump sum
sy	square yard

(1) Capital costs not required for existing new asphalt pavement (245 sy).
(2) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(3) Gravel Base Course not required at areas with old asphalt.
(4) 10 % includes inspection and maintenance of new asphalt cover and existing asphalt pavement.
(5) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-9: SWMU 21 - Alternative 2: *Excavation, Solidification/Stabilization, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
UXO Clearance	1,700	sy	10.00	17,000
Stabilization Pretreatment Testing	1	ls	30,000.00	30,000
Mobilization/Demobilization	1	ls	30,000.00	30,000
Ground Preparation/Clearing	1,700	sy	0.20	400
Soil Excavation	850	cy	20.00	17,000
Backfilling	850	cy	10.00	8,500
Confirmation Sampling	85	sample	175.00	14,900
Treatment Pad and Stockpile Area	1	ls	10,000.00	10,000
Transport to CAMU	850	cy	10.00	8,500
Soil Cover at CAMU	200	cy	10.00	2,000
Soil Profile and Analytical Costs	9	sample	1,300.00	11,700
Solidification/Stabilization	1,190	ton	75.00	89,300
Grading	16	msf	48.00	800
Gravel Cover	1,455	sy	4.00	5,900
Asphalt Repaving	245	sy	18.00	4,500
Subtotal Direct Capital Costs				255,500
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				51,100
Health and Safety Equipment & Training (5% of direct costs)				12,800
Legal and Administrative (5% of direct costs)				12,800
Project Management (10% of direct costs)				25,600
Subtotal Indirect Capital Costs				102,300
Total Capital Costs				357,800
O&M Costs				
Five Year Site Inspection for stab. soil	1	ea	15,000	15,000
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Present Worth O&M Costs (30 years @ 7% Discount Rate)				36,400
Subtotal Cost of Alternative				394,200
Contingency (@ 20%)				78,840
Total Cost of Alternative				480,000

Key to unit abbreviations	
cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-10: SWMU 21 - Alternative 3: *Excavation, Soil Washing, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
UXO Clearance	1,700	sy	10.00	17,000
Soil Washing Pretreatment Testing	1	ls	30,000.00	30,000
Mobilization/Demobilization	1	ls	40,000.00	40,000
Ground Preparation/Clearing	1,700	sy	0.20	400
Treatment Pad and Stockpile Area	1	ls	10,000.00	10,000
Soil Excavation	850	cy	20.00	17,000
Backfilling	850	cy	8.00	6,800
Soil Washing (2)	1,190	ton	100.00	119,000
Confirmation Sampling	85	sample	175.00	14,900
Soils Profile and Analytical Costs	9	sample	1,300.00	11,700
Transport to TSDF/Landfill	130	cy	70.00	9,100
TSDF/Subtitle C Landfill Disposal Cost	180	ton	150.00	27,000
Grading	16	msf	48.00	800
Gravel Cover	1,455	sy	4.00	5,900
Asphalt Repaving	245	sy	18.00	4,500
Subtotal Direct Capital Costs				319,100
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				63,900
Health and Safety Equipment & Training (5% of direct costs)				16,000
Legal and Administrative (5% of direct costs)				16,000
Project Management (10% of direct costs)				32,000
Subtotal Indirect Capital Costs				127,900
Total Capital Costs				447,000
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (3)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				451,000
Contingency (@ 20%)				90,200
Total Cost of Alternative				550,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) If acid leaching is required in the soil washing process (as determined by the treatibility study) the cost of treatment will be increased to approximately $200 per ton
(3) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-11: SWMU 21 - Alternative 4: *Excavation, Off-Post Treatment/Disposal, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
UXO Clearance	1,700	sy	10.00	17,000
Mobilization/Demobilization	1	ls	5,000.00	5,000
Ground Preparation/Clearing	1,700	sy	0.20	400
Soil Excavation	850	cy	20.00	17,000
Backfilling Clean Soil	850	cy	10.00	8,500
Confirmation Sampling	85	sample	175.00	14,900
Soil Profile and Analytical Costs	9	sample	1,300.00	11,700
Transport to TSDF/Landfill	850	cy	70.00	59,500
TSDF/Subtitle C Landfill Disposal Cost	1,190	ton	150.00	178,500
Grading	16	msf	48.00	800
Gravel Cover	1,455	sy	4.00	5,900
Asphalt Repaving	245	sy	18.00	4,500
Subtotal Direct Capital Costs				328,700
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				65,800
Health and Safety Equipment & Training (5% of direct costs)				16,500
Legal and Administrative (5% of direct costs)				16,500
Project Management (10% of direct costs)				32,900
Subtotal Indirect Capital Costs				131,700
Total Capital Costs				460,400
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				464,400
Contingency (@ 20%)				92,880
Total Cost of Alternative				560,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-12: SWMU 34 - Alternative 1: *Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Subtotal Direct Capital Costs				5,000
Indirect Capital Costs				
Administrative (5% of direct costs)				250
Project Management (10% of direct costs)				500
Subtotal Indirect Capital Costs				800
Total Capital Costs				5,800
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				9,800
Contingency (@ 20%)				1,960
Total Cost of Alternative				12,000

Key to unit abbreviations	
ls	lump sum

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-13: SWMU 34 - Alternative 2: *Soil Cover, Fence, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs (1)				
Land Use Restrictions (2)	1	ls	5,000.00	5,000
Mobilization/Demobilization	1	ls	3,000.00	3,000
Ground Preparation/Clearing	54	sy	0.20	100
Soil/Gravel Cover (1 ft)	18	cy	15.00	300
Subtotal Direct Capital Costs				8,400
Indirect Capital Costs				
Engineering and Construction Management (30% of direct costs)				2,600
Health and Safety Equipment & Training (5% of direct costs)				500
Legal and Administrative (5% of direct costs)				500
Project Management (20% of direct costs)				1,700
Subtotal Indirect Capital Costs				5,300
Total Capital Costs				13,700
O&M Costs				
Annual Inspection and Maintenance	15% of direct capital costs (3)			1,260
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (4)	1	each	0	0
Subtotal O&M Costs				1,600
Present Worth O&M Costs (30 years @ 7% Discount Rate)				22,000
Subtotal Cost of Alternative				35,700
Contingency (@ 20%)				7,140
Total Cost of Alternative				43,000

Key to unit abbreviations	
ls	lump sum
sy	square yard
cy	cubic yard

(1) Capital costs not required for existing fence and existing pavement at SS34011 (38 sy).
(2) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(3) 15 % includes inspection and maintenance of new soil cover, existing pavement, and existing fence.
(4) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-14: SWMU 34 - Alternative 3: *Excavation, Off-Post Treatment/Disposal, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Mobilization/Demobilization	1	ls	5,000.00	3,000
Ground Preparation/Clearing	92	sy	0.20	100
Soil Excavation	31	cy	20.00	700
Backfilling Clean Soil	31	cy	10.00	400
Confirmation Sampling	3	sample	215.00	700
Soil Profile and Analytical Costs	1	sample	1,300.00	1,300
Transport to TSDF/Landfill	31	cy	70.00	2,200
TSDF/Subtitle C Landfill Disposal Cost	44	ton	450.00	19,800
Grading	1	msf	48.00	100
Gravel Cover	54	sy	4.00	300
Asphalt Repaving (at SS-34-011)	38	sy	18.00	700
Subtotal Direct Capital Costs				34,300
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				6,900
Health and Safety Equipment & Training (5% of direct costs)				1,800
Legal and Administrative (5% of direct costs)				1,800
Project Management (10% of direct costs)				3,500
Subtotal Indirect Capital Costs				14,000
Total Capital Costs				48,300
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				52,300
Contingency (@ 20%)				10,460
Total Cost of Alternative				63,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-15: SWMU 37 - Alternative 1: *Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Subtotal Direct Capital Costs				5,000
Indirect Capital Costs				
Administrative (5% of direct costs)				250
Project Management (10% of direct costs)				500
Subtotal Indirect Capital Costs				800
Total Capital Costs				5,800
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				9,800
Contingency (@ 20%)				1,960
Total Cost of Alternative				12,000

Key to unit abbreviations	
ls	lump sum

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-16: SWMU 42 - Alternative 1: Soil *Cover, Fence, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs (1)				
Land Use Restrictions (2)	1	ls	5,000.00	5,000
Mobilization/Demobilization	1	ls	10,000.00	10,000
UXO Clearance	3,235	sy	10.00	32,400
Ground Preparation/Clearing	3,235	sy	0.20	700
Soil Excavation and placing at ditch/pond (3)	1,740	cy	30.00	52,200
Backfilling Clean Soil (3)	1,740	cy	10.00	17,400
Confirmation Sampling (3)	174	sample	175.00	30,500
PVC Liner for ditch and former holding pond	1,500	sy	7.00	10,500
Soil Cover (1 ft)	500	cy	15.00	7,500
Grading	33	msf	48.00	1,600
Temporary Erosion Control	3,235	sy	1.40	4,600
Revegetation/Seeding	3,235	sy	0.22	800
Subtotal Direct Capital Costs				173,200
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				34,700
Health and Safety Equipment & Training (5% of direct costs)				8,700
Legal and Administrative (5% of direct costs)				8,700
Project Management (10% of direct costs)				17,400
Subtotal Indirect Capital Costs				69,500
Total Capital Costs				242,700
O&M Costs				
Annual Inspection and Maintenance	10% of direct capital costs (4)			13,580
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (5)	1	each	0	0
Subtotal O&M Costs				13,900
Present Worth O&M Costs (30 years @ 7% Discount Rate)				185,000
Subtotal Cost of Alternative				427,700
Contingency (@ 20%)				85,540
Total Cost of Alternative				520,000

Key to unit abbreviations	
ls	lump sum
sy	square yard
cy	cubic yard
msf	thousand square feet

(1) Capital costs not required for existing pavement at SB42003 (295 sy).
(2) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(3) Soil from three hot spots of isolated contamination will be excavated and consolidated into the ditch/holding pond area.
(4) 10 % includes inspection and maintenance of the new cover, existing pavement, and fence. The annual cost is 10% of direct capital cost without land use restrictions and UXO clearance.
(5) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-17: SWMU 42 - Alternative 2: *Excavation, Solidification/Stabilization, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
UXO Clearance	3,530	sy	10.00	35,300
Stabilization Pretreatment Testing	1	ls	10,000.00	10,000
Mobilization/Demobilization	1	ls	40,000.00	40,000
Ground Preparation/Clearing	3,530	sy	0.20	800
Soil Excavation	3,530	cy	20.00	70,600
Backfilling	3,530	cy	10.00	35,300
Confirmation Sampling	353	sample	175.00	61,800
Treatment Pad and Stockpile Area	1	ls	10,000.00	10,000
Transport to CAMU	3,530	cy	10.00	35,300
Soil Cover at CAMU	900	cy	10.00	9,000
Soil Profile and Analytical Costs	35	sample	1,300.00	45,500
Solidification/Stabilization	4,940	ton	75.00	370,500
Grading	32	msf	48.00	1,600
Revegetation/Seeding	3,530	sy	0.22	800
Subtotal Direct Capital Costs				731,500
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				146,300
Health and Safety Equipment & Training (5% of direct costs)				36,600
Legal and Administrative (5% of direct costs)				36,600
Project Management (10% of direct costs)				73,200
Subtotal Indirect Capital Costs				292,700
Total Capital Costs				1,024,200
O&M Costs				
Five Year Site Inspection of stab. soil	1	ea	15,000	15,000
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Present Worth O&M Costs (30 years @ 7% Discount Rate)				36,400
Subtotal Cost of Alternative				1,060,600
Contingency (@ 20%)				212,120
Total Cost of Alternative				1,280,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-18: SWMU 42 - Alternative 3: *Excavation, Soil Washing, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
UXO Clearance	3,530	sy	10.00	35,300
Soil Washing Pretreatment Testing	1	ls	10,000.00	10,000
Mobilization/Demobilization	1	ls	50,000.00	50,000
Ground Preparation/Clearing	3,530	sy	0.20	800
Treatment Pad and Stockpile Area	1	ls	10,000.00	10,000
Soil Excavation	3,530	cy	20.00	70,600
Backfilling	3,530	cy	8.00	28,300
Soil Washing (2)	4,940	ton	100.00	494,000
Confirmation Sampling	353	sample	175.00	61,800
Soils Profile and Analytical Costs	35	sample	1,300.00	45,500
Transport to TSDF/Landfill	530	cy	70.00	37,100
TSDF/Subtitle C Landfill Disposal Cost	740	ton	150.00	111,000
Grading	32	msf	48.00	1,600
Revegetation/Seeding	3,530	sy	0.22	800
Subtotal Direct Capital Costs				961,800
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				192,400
Health and Safety Equipment & Training (5% of direct costs)				48,100
Legal and Administrative (5% of direct costs)				48,100
Project Management (10% of direct costs)				96,200
Subtotal Indirect Capital Costs				384,800
Total Capital Costs				1,346,600
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (3)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				1,350,600
Contingency (@ 20%)				270,120
Total Cost of Alternative				1,630,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) If acid leaching is required in the soil washing process (as determined by the treatibility study) the cost of treatment will be increased to approximately $200 per ton.
(3) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-19: SWMU 42 - Alternative 4: *Excavation, Off-Post Treatment/Disposal, and Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Mobilization/Demobilization	1	ls	10,000.00	10,000
UXO Clearance	3,530	sy	10.00	35,300
Ground Preparation/Clearing	3,530	sy	0.20	800
Soil Excavation	3,530	cy	20.00	70,600
Backfilling Clean Soil	3,530	cy	10.00	35,300
Confirmation Sampling	353	sample	175.00	61,800
Soil Profile and Analytical Costs	35	sample	1,300.00	45,500
Transport to TSDF/Landfill	3,530	cy	70.00	247,100
TSDF/Subtitle C Landfill Disposal Cost	4,940	ton	150.00	741,000
Grading	32	msf	48.00	1,600
Revegetation/Seeding	3,530	sy	0.22	800
Subtotal Direct Capital Costs				1,254,800
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				251,000
Health and Safety Equipment & Training (5% of direct costs)				62,800
Legal and Administrative (5% of direct costs)				62,800
Project Management (10% of direct costs)				125,500
Subtotal Indirect Capital Costs				502,100
Total Capital Costs				1,756,900
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	each	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				1,760,900
Contingency (@ 20%)				352,180
Total Cost of Alternative				2,120,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site.
(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-20: SWMU 45 - Alternative 1: *Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Subtotal Direct Capital Costs				5,000
Indirect Capital Costs				
Administrative (5% of direct costs)				250
Project Management (10% of direct costs)				500
Subtotal Indirect Capital Costs				800
Total Capital Costs				5,800
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	ea	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				9,800
Contingency (@ 20%)				1,960
Total Cost of Alternative				12,000

Key to unit abbreviations	
ls	lump sum
ea	each

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site

(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

Table A-21: SWMU 48 - Alternative 1: *Land Use Restrictions* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Land Use Restrictions (1)	1	ls	5,000.00	5,000
Subtotal Direct Capital Costs				5,000
Indirect Capital Costs				
Administrative (5% of direct costs)				250
Project Management (10% of direct costs)				500
Subtotal Indirect Capital Costs				800
Total Capital Costs				5,800
O&M Costs				
Site Inspections (hours per year)	5	hour	60	300
Five Year Site Reviews (2)	1	ea	0	0
Subtotal O&M Costs				300
Present Worth O&M Costs (30 years @ 7% Discount Rate)				4,000
Subtotal Cost of Alternative				9,800
Contingency (@ 20%)				1,960
Total Cost of Alternative				12,000

Key to unit abbreviations	
ls	lump sum
ea	each

(1) Capital costs for land use restrictions include a site management plan, survey, and description of the site

(2) Cost for Base-wide Five Year Site Reviews is programmed as part of TEAD's program management budget.

APPENDIX B

Post-Corrective Measures
Ecological Risks at SWMUs 21 and 42

CONTENTS

TABLES

EXHIBITS

Post-Corrective Measures Ecological Risks
at SWMUs 21 and 42

B.1 INTRODUCTION

Based on results of the Revised Final Site-Wide Ecological Risk Assessment (SWERA; Rust E&I, 1997) performed at Tooele Army Depot (TEAD), Tooele, Utah, each solid waste management unit (SWMU) was characterized as posing low, moderate, or potentially unacceptable ecological risk. For those SWMUs characterized as posing unacceptable ecological risk, the SWERA recommended consideration of ecological risk reduction as part of corrective measures to be evaluated based on human health concerns. The purpose of this appendix is to summarize the evaluation of ecological risk under post-corrective measures activities for SWMUs 21 and 42, which were determined in the SWERA to pose potentially unacceptable ecological risks.

B.2 METHODOLOGY

The SWERA (Rust E&I, 1997) used both a "historic" and a "current" dataset in the evaluation of ecological risk. The historic dataset consists of data obtained through the Installation Restoration Data Management Information System (IRDMIS) database for 1994 to 1995. Because additional sampling has occurred since 1995 for some SWMUs, there may be differences between the data currently available and the historic data used in the SWERA. The current dataset consists of data collected by Rust E&I for biotic and abiotic media at the reference study area (RSA; background site) and 10 SWMUs, including SWMUs 21 and 42. The SWERA calculated potential ecological risks for each SWMU using the historic or the current datasets.

Because the two datasets contain different types and amount of data, the SWERA estimated ecological risks using both sets of data independently. For the historic dataset, ecological risks to various receptors were calculated based on the soil consumption route of exposure only. For the current dataset, ecological risks were calculated using a dynamic food chain model. Thus, risk estimates based on the current dataset include both soil and prey consumption routes of exposure. For those SWMUs for which both historic and current data are available, two separate estimates of ecological risk were generated; the higher risk level was used to characterize the risk identified at the SWMU.

To evaluate alternative corrective measures for SWMUs 21 and 42 in this Corrective Measures Study (CMS; see Sections 6.0 and 9.0, respectively), the post-corrective measures risks are assessed using the methodology originally described in the SWERA to quantify ecological risk. In general, this method involves the following steps:

- Identify all data used in the SWERA for each SWMU and identify the main risk drivers (i.e., those contaminants of potential concern (COPCs) that contribute to ecological risk) for each receptor.

- Identify the corrective measures to be considered at the SWMU.

- Identify those sample locations that will be affected as a result of each corrective measure.

- Estimate post-corrective measures soil concentrations for each sample previously identified.

- Recalculate the SWMU soil concentration terms (C_{terms}) for the main risk drivers.

- Recalculate the hazard quotients and indices (HQs and HIs) for each receptor of concern at the SWMU. Compare the recalculated risk estimate to the RSA risk, and calculate the percent risk reduction associated with each corrective measure evaluated.

The method used to calculate ecological risk from the soil concentration (C_{term}) of a COPC is dependent on the source of the data used (historic or current dataset) to characterize the SWMU. For those sites for which risk characterization is based on the historic dataset, the HQ is calculated as:

$$HQ = \frac{C_{term} * SIR * AUF}{TBV} \qquad \text{(Eq B-1)}$$

where:

C_{term}	=	recalculated soil concentration term for a selected COPC
SIR	=	soil ingestion rate for the receptor of concern
AUF	=	area use factor for the receptor of concern
TBV	=	toxicity benchmark value for the receptor of concern.

The SWERA defined the soil ingestion rate, area use factor, and toxicity benchmark values – which are used in this CMS without modification. The HI is calculated as the sum of all of the HQ values calculated for a specific SWMU.

For both SWMUs 21 and 42, the ecological risks calculated in the SWERA using the historic dataset were found to be more conservative than the corresponding risks based on the current dataset. Therefore, the post-corrective measures ecological risks presented in Sections B.3 and B.4 for SWMUs 21 and 42, respectively, are based on the historic dataset. For each corrective measures alternative considered in the CMS, the resulting post-corrective measures HIs are calculated. These values are compared in the following sections to the corresponding HI values for the RSA. The ecological risk estimates for each corrective measures alternative are then expressed in terms of the following parameters: (1) the RSA multiplier, which is the ratio of the post-corrective measures HI to the RSA HI; and (2) the percent risk reduction, which is the percent reduction in value of the post-corrective measures HI compared to the baseline value for the site. The results of these post-corrective measures risk evaluations are then used in selecting the preferred corrective measures for SWMUs 21 and 42 in Sections 6.0 and 9.0 of the CMS, respectively.

B.3 DEACTIVATION FURNACE BUILDING (SWMU 21)

B.3.1 INTRODUCTION

Based on results of the ecological risk assessment (RA), the SWERA (Rust E&I, 1997) characterized SWMU 21 as posing potentially unacceptable ecological risks. It recommended consideration of ecological risk reduction as part of corrective measures to address human health concerns. Specific factors considered in the risk characterization are as follows:

- Risk to passerine birds was approximately 11 times the estimated RSA risk, and was driven by lead (27 percent contribution to estimated risk), thallium (14 percent), and dioxin (17 percent).

- Risks to raptors and special status species were less than the estimated RSA risks.

- Risk to mammals exceeded the estimated RSA risk. The risk to deer mice was approximately 2.5 times the RSA risk. Lead accounted for over 42 percent of the HI; iron, 23 percent; and copper, 16 percent.

- Risks to plants and soil fauna exceeded the estimated RSA risks. The HI associated with plants was approximately 12.5 times the estimated RSA HI; for soil fauna, the HI was 76 times the estimated RSA HI. Cadmium accounted for 18.6 percent of the risk to plants, followed by copper (15.7 percent) and lead (7 percent). Risks to soil fauna were driven by chromium (65 percent) and iron (15 percent) using the current dataset. However, a high degree of uncertainty is associated with these risk estimates due to limited toxicological information.

Changes in ecological risk to the passerine bird, deer mouse, soil fauna, and plant receptors at SWMU 21 are evaluated for each of the identified corrective measures alternatives, based on estimated reductions in the concentrations of lead and other COPC risk drivers in soil at the site.

B.3.2 ECOLOGICAL RISK EVALUATION STRATEGY

Based on results of the human health RA, the CMS Work Plan (Dames & Moore, 2000) indicated that corrective actions to be evaluated in the CMS Report for SWMU 21 should focus primarily on lead. In addition, the post-corrective measures ecological RAs focus on other COPCs that contribute at least 5 percent of the estimated risk for at least one of the receptors under consideration. For SWMU 21, the additional COPCs are cadmium, chromium, copper, and zinc. Reductions in ecological risk are calculated based on the post-corrective measures soil concentrations of these metals. In general, this method involves identification of the corrective measures to be considered at SWMU 21 and the corresponding sample locations, and recalculation of post-corrective measures soil exposure concentrations. Given this information, the risk to receptors of concern is recalculated using the methodologies presented in detail in the SWERA (Rust E&I, 1997) and summarized in Section B.2.

B.3.3 ESTIMATION OF POST-CORRECTIVE MEASURES SOIL CONCENTRATIONS

Table B-1 – presented at the end of this appendix along with the other tables – lists the post-corrective measures concentrations of the COPC risk drivers in soil at SWMU 21. It should be noted that Table B-1 includes data collected in 1995 from the drainage area, which was not included in the SWERA; these data are not considered in this evaluation. It is assumed that corrective measures are applied to reduce the soil concentrations of lead (and other COPCs) in portions of the site that contain samples SS21001, SS21002, SS21002, SS21003, SS21004, SS21007, SS21008, SS21009, and SS21010 (Table B-1). Soil associated with samples SS21005 and SS21005DUP was previously remediated because of 2,4,6-trinitrotoluene (TNT) concerns (Dames & Moore, 2000). Thus, the values in the historic dataset for the primary risk-driving COPCs for these samples were replaced by their respective 95 percent upper confidence level (UCL) background values, and 2,4,6-TNT was removed as a COPC. Appendix B of the CMS Work Plan (Dames & Moore, 2000) shows the locations of the above samples.

The corrective measures considered for SWMU 21 are presented below, together with assumptions employed in the post-corrective measures risk evaluations:

- Asphalt cover and land use restrictions (Alternative 1) – For this corrective measure, it is assumed that the soil concentrations of all COPCs under consideration are reduced to zero and that no receptors are exposed to COPCs.

- Excavation, solidification/stabilization, and land use restrictions (Alternative 2) – For this corrective measure, it is assumed that solidified/stabilized soil will be moved to the SWMU 12/15 (Known Releases) landfill. The clean soil used for backfill is assumed to have COPC concentrations equal to background conditions. (See Table A-10 of the CMS Work Plan for all metals background concentrations (Dames & Moore, 2000).)

- Excavation, soil washing, and land use restrictions (Alternative 3) – For this corrective measure, it is assumed that post-remedial concentrations of lead in the impacted areas are reduced to the human health corrective action objective (CAO) of 1,800 milligrams per kilogram (mg/kg). It is further assumed that other metal COPCs are likely to be associated with the fine-grained soil material separated from the cleaned soil and that these concentrations are reduced by approximately 40 percent.

- Excavation, off-post treatment/disposal, and land use restrictions (Alternative 4) – For this corrective measure, it is assumed that the clean soil used for backfill has COPC concentrations equal to background conditions. Table A-10 of the CMS Work Plan presents the background metals concentrations used in this evaluation (Dames & Moore, 2000).

For those samples within the designated corrective measures area, post-corrective measures soil concentrations were substituted in the dataset for the original soil concentrations used in the SWERA. Specifically, for Alternative 1, the concentration of each COPC in surface soil is assumed to be 0.0. For Alternatives 2 and 4, the COPC background concentration is substituted for all samples within the designated corrective measures area. For Alternative 3, the lead concentration for each sample is assumed to be 1,800 mg/kg; additionally, a value equal to 60 percent of the original concentration is substituted into the original dataset for the other COPCs under consideration. Because the estimation of post-corrective measures soil concentrations results in a new soil dataset for SWMU 21, the C_{term} (soil exposure term) is recalculated for each corrective measure.

B.3.4 ESTIMATED POST-CORRECTIVE MEASURES ECOLOGICAL RISKS

The post-corrective measures values of HQ and HI are presented together with the corresponding baseline values in Tables B-2 through B-5 for passerine bird, deer mouse, soil fauna, and plant receptors, respectively. These tables also show the calculated RSA multiplier and percent risk reduction values for each corrective measures alternative. Exhibit B-1 summarizes the calculated RSA multiplier and percent risk reduction values for each of the ecological receptors of concern.

Overall, Alternative 1 offers the greatest reduction of risk for SWMU 21. However, asphalt paving of the site completely removes all ecological habitat, which may not be desirable. Alternatives 2 and 4 are equal and the next most effective measure for reduction of risk, followed by Alternative 3. Using the risk characterization developed in the SWERA (Rust E&I, 1997), post-remedial ecological risks are classified as follows for each of the corrective measures considered:

- No risks for all receptors of concern (Alternative 1).

- Low risks for passerine birds, deer mice, and plants; low-to-moderate risk for soil fauna (Alternative 2).

- Low risk for deer mice, moderate risk for passerine birds, and potentially unacceptable risks for soil fauna and plants (Alternative 3).

- Low risks for passerine birds, deer mice, and plants; low-to-moderate risk for soil fauna (Alternative 4).

B.4 BOMB WASHOUT BUILDING (SWMU 42)

B.4.1 INTRODUCTION

Based on results of the ecological RA, the SWERA (Rust E&I, 1997) characterized SWMU 42 as posing potentially unacceptable ecological risks. It recommended consideration of ecological risk reduction as part of corrective measures to address human health concerns. Specific factors considered in the risk characterization are as follows:

- Risk to passerine birds was approximately 10 times the estimated RSA risk. The primary risk drivers were lead (29 percent contribution to estimated risk), thallium (20 percent), and dioxins (24 percent).

- Risks to raptors and special status species were less than the estimated RSA risks.

- Risks to mammals (i.e., deer mice, mule deer, and jackrabbits) were approximately 6, 1.1, and 4 times the estimated RSA risks, respectively. The primary risk drivers were metals, dioxins, and explosives in soil. Iron accounted for over 10 percent of the risk estimates for all three receptors.

- Risks to soil plants and fauna exceeded the estimated RSA risks. However, a high degree of uncertainty is associated with these risk estimates because of limited toxicological information.

Changes in ecological risk to the passerine bird, deer mouse, jackrabbit, soil fauna, and soil plant receptors at SWMU 42 are evaluated for each of the corrective measures alternatives, based on estimated reductions in the concentrations of lead and other COPC risk drivers in soil at the site. Changes in risk to the mule deer receptor are not considered in this evaluation because of its low risk relative to the RSA.

B.4.2 ECOLOGICAL RISK EVALUATION STRATEGY

Based on results of the human health RA, the CMS Work Plan (Dames & Moore, 2000) indicated that corrective actions to be evaluated in the CMS Report for SWMU 42 should focus primarily on lead. In addition, the post-corrective measures ecological RAs focus on other COPCs that contribute at least 5 percent of the estimated risk for at least one of the receptors under consideration. For SWMU 42, the additional COPCs are antimony, barium, chromium, copper, thallium, and zinc. Reductions in ecological risk are calculated based on the post-corrective measures soil concentrations of these metals. In general, this method involves identification of the corrective measures to be considered at SWMU 42 and the corresponding sample locations, and recalculation of post-corrective measures soil exposure concentrations. Given this information, the risk to receptors of concern is recalculated using the methodologies presented in detail in the SWERA (Rust E&I, 1997) and summarized in Section B.2.

B.4.3 ESTIMATION OF POST-CORRECTIVE MEASURES SOIL CONCENTRATIONS

Table B-6 lists the post-corrective measures concentrations of the COPC risk drivers in soil at SWMU 42. It is assumed that corrective measures are applied to reduce the soil concentrations of lead (and other COPCs) in portions of the site that contain samples SB42003, SB42006, SB42007, SB42008, SB42010, SB42012, SB42013, SB42017, SB42050, SS42003, SS42004, SS42007, SS42008, SS42009, SS42011, and SS42013 (Table B-6). Appendix B of the CMS Work Plan (Dames & Moore, 2000) shows the locations of the above samples.

The corrective measures considered for SWMU 42 are presented below, together with assumptions employed in the post-corrective measures risk evaluations:

- Soil cover, fence, and land use restrictions (Alternative 1) – For this corrective measure, it is assumed that the soil cover has COPC metal concentrations equal to background soil.

- Excavation, solidification/stabilization, and land use restrictions (Alternative 2) – For this corrective measure, it is assumed that solidified/stabilized soil will be moved to the SWMU 12/15 (Known Releases) landfill. The clean soil used for backfill is assumed to have COPC concentrations equal to background conditions. (See Table A-10 of the CMS Work Plan for all metals background concentrations (Dames & Moore, 2000).)

- Excavation, soil washing, and land use restrictions (Alternative 3) – For this corrective measure, it is assumed that post-remedial concentrations of lead in the impacted areas are reduced to the human health CAO of 1,800 mg/kg. It is further assumed that other metal COPCs are likely to be associated with the fine-grained soil material separated from the cleaned soil and that these concentrations are reduced by 40 percent.

- Excavation, off-post treatment/disposal, and land use restrictions (Alternative 4) – For this corrective measure, it is assumed that the clean soil used for backfill has COPC concentrations equal to background conditions. Table A-10 of the CMS Work Plan (Dames & Moore, 2000) presents the background metals concentrations used in this evaluation.

For those samples within the designated corrective measures area, post-corrective measures soil COPC concentrations are substituted in the dataset for the original soil concentrations used in the SWERA. Specifically, for Alternatives 1, 2, and 4 above, the COPC background concentration is substituted for all samples collected within the corrective measures area. For Alternative 3, the lead concentration for each sample is assumed to be 1,800 mg/kg; additionally, a value equal to 60 percent of the original concentration is substituted into the original dataset for barium, chromium, copper, thallium, antimony, and zinc. Because the estimation of post-corrective measures soil concentrations results in a new soil dataset for SWMU 42, the C_{term} (soil exposure term) is recalculated for each corrective measure.

B.4.4 ESTIMATED POST-CORRECTIVE MEASURES ECOLOGICAL RISKS

The post-corrective measures values of HQ and HI are presented together with the corresponding baseline values in Tables B-7 through B-11 for passerine bird, deer mouse, jackrabbit, soil fauna, and plant receptors, respectively. These tables also show the calculated RSA multiplier and percent risk reduction values for each corrective measures alternative. Exhibit B-2 summarizes the calculated RSA multiplier and percent risk reduction values for each of the ecological receptors of concern.

Alternatives 1, 2, and 4 offer the highest reduction of ecological risk for SWMU 42. Alternative 3 results in the least reduction of ecological risk. Risks posed to ecological receptors by post-corrective measures conditions are similar to those estimated at the RSA for Alternatives 1, 2, and 4. Using the risk characterization developed in the SWERA (Rust E&I, 1997), post-remedial ecological risks are classified as follows for each of the corrective measures considered:

- Low ecological risk for all receptors of concern – a minimum risk reduction of 70 percent (Alternatives 1, 2, and 4).

- Low-to-moderate ecological risks, with risks to soil fauna being the highest relative to the RSA (Alternative 3).

TABLE B-1

Post-Corrective Measures COPC Concentrations in Soil at SWMU 21 (a)

	Soil Washing					**Solidification/Stabilization and Off-Post Treatment/Disposal (Including Backfilling of Excavation)**				
	Corrective Measure Alternative 3					**Corrective Measure Alternatives 2 and 4**				
	Pb	**Cd**	**Cr**	**Cu**	**Zn**	**Pb**	**Cd**	**Cr**	**Cu**	**Zn**
SS21001 (0)	**1800**	**26.88**	**19.56**	**541.8**	**660**	**96.7**	**1.33**	**23**	**39.9**	**137**
SS21002 (0)	**1800**	**78**	**36.42**	**864**	**2382**	**96.7**	**1.33**	**23**	**39.9**	**137**
SS21003 (0)	**1800**	**59.16**	**23.4**	**1080**	**1566**	**96.7**	**1.33**	**23**	**39.9**	**137**
SS21004 (0)	**1800**	**99.6**	**40.98**	**2100**	**2562**	**96.7**	**1.33**	**23**	**39.9**	**137**
SS21005 (0)	1800	1.33	23	39.9	137	96.7	1.33	23	39.9	137
SS21006 (0)	748	13.1	15.2	361	485	748	13.1	15.2	361	485
SS21007 (0)	**1800**	**46.74**	**29.76**	**2280**	**4320**	**96.7**	**1.33**	**23**	**39.9**	**137**
SS21008 (0)	**1800**	**45**	**60**	**17400**	**11400**	**96.7**	**1.33**	**23**	**39.9**	**137**
SS21009 (0)	**1800**	**542.4**	**148.8**	**9000**	**10800**	**96.7**	**1.33**	**23**	**39.9**	**137**
SS21010 (0)	**1800**	**195**	**82.2**	**2400**	**7200**	**96.7**	**1.33**	**23**	**39.9**	**137**
SS21011 (.5)	NA	NA	8.42	NA	NA	NA	NA	8.42	NA	NA
SS21012 (.5)	NA	NA	57.6	NA	NA	NA	NA	57.6	NA	NA
SS21013 (.5)	NA	NA	101.2	NA	NA	NA	NA	101.2	NA	NA
SS21014 (.5)	NA	NA	19.6	NA	NA	NA	NA	19.6	NA	NA
Count	10	10	14	10	10	10	10	14	10	10
Mean	1694.80	110.72	47.58	3606.67	4151.20	161.83	2.51	29.22	72.01	206.60
Dev.	332.67	161.33	39.61	5491.27	4218.44	205.96	3.72	23.30	101.54	155.63
t-Value	1.8331	1.8331	1.7709	1.8331	1.8331	1.8331	1.8331	1.7709	1.8331	1.8331
Std. Error	192.84	93.52	18.75	3183.16	2445.34	119.39	2.16	11.03	58.86	90.22
UCL	1887.64	204.24	66.33	6789.83	6596.54	281.22	4.66	40.24	130.87	296.82
Min	748	1.33	8.42	39.9	4320	96.7	1.33	8.42	39.9	137
Max	1800	542.4	148.8	17400	11400	748	13.1	101.2	361	485

(a) All concentrations presented in milligrams per kilogram (mg/kg; parts per million (ppm).) Bold entries represent those samples falling within the corrective measures area.

TABLE B-2

Estimated Changes in Ecological Risk to Passerine Bird Receptors at SWMU 21

	Baseline Risk (a)		Corrective Measures Alternative					
	SWERA		1 – Asphalt Cover		3 – Soil Washing		2 and 4 – Solidification/ Stabilization and Off-Post Treatment/Disposal (b)	
	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)
Silver	6.47	0.155	0.0	0.0	6.47	0.155	6.47	0.155
Arsenic	13.12	0.280	0.0	0.0	13.12	0.280	13.12	0.280
Barium	4021.06	12.395	0.0	0.0	4021.06	12.395	4021.06	12.395
Beryllium	1.19	0.004	0.0	0.0	1.19	0.004	1.19	0.004
Cadmium	**288.64**	**132.774**	**0.0**	**0.0**	**204.24**	**93.950**	**4.66**	**2.144**
Cobalt	6.37	0.002	0.0	0.0	6.37	0.002	6.37	0.002
Chromium/hexachrome	**1292.54**	**297.284**	0.0	0.0	**66.33**	**15.256**	**40.24**	**9.255**
Copper	**8157.95**	**44.109**	0.0	0.0	**6789.8**	**36.712**	**130.87**	**0.708**
Dioxin, furan	4.45E-04	0.051	0.0	0.0	4.45E-04	0.051	4.45E-04	0.051
Iron	47927.39	36.744	0.0	0.0	47927.39	36.744	47927.3	36.744
Mercury	0.054	0.006	0.0	0.0	0.054	0.006	0.054	0.006
Manganese	709.88	0.518	0.0	0.0	709.88	0.518	709.88	0.518
Nickel	76.67	0.788	0.0	0.0	76.67	0.788	76.67	0.788
Lead	**18136.33**	**373.984**	0.0	0.0	**1887.6**	**38.924**	**281.22**	**5.799**
Phthalate	0.1624	0.078	0.0	0.0	0.1624	0.005	0.1624	0.005
Selenium	1.76	0.810	0.0	0.0	1.76	0.810	1.76	0.810
Thallium	36.72	43.917	0.0	0.0	36.72	43.917	36.72	43.917
Zinc	**9330.26**	**103.324**	0.0	0.0	**6596**	**73.045**	**296.82**	**3.287**
HI (e)		1047.22		0.0		353.561		116.87
RSA multiplier (f)		11.61		0.0		3.92		1.30
% Risk reduction (g)		NA		100%		66%		89%

(a) Risk calculated in SWERA (Rust E&I, 1997).
(b) Includes excavation of contaminated soil and backfilling clean soil in excavation.
(c) Soil concentration term.
(d) Hazard quotient.
(e) Hazard indices calculated as the sum of hazard quotients.
(f) Calculated as HI/RSA of 90.2.
(g) Risk reduction = (1047.22 – HI)/1047.22.

TABLE B-3

Estimated Changes in Ecological Risk to Deer Mouse Receptors at SWMU 21

	Baseline Risk (a)		Corrective Measures Alternative					
	SWERA		1 – Asphalt Cover		3 – Soil Washing		2 and 4 – Solidification/ Stabilization and Off-Post Treatment/Disposal (b)	
	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)
Silver	6.47	0.001	0.0	0.0	6.47	0.001	6.47	0.001
Arsenic	13.12	0.022	0.0	0.0	13.12	0.022	13.12	0.022
Barium	4021.06	2.139	0.0	0.0	4021.06	2.139	4021.06	2.139
Beryllium	1.19	0.000	0.0	0.0	1.19	0.000	1.19	0.000
Cadmium	**288.64**	0.732	**0.0**	**0.0**	**203.19**	**0.516**	**4.64**	**0.012**
Cobalt	6.37	0.168	0.0	0.0	6.37	0.168	6.37	0.168
Chromium/hexachrome	**1292.54**	0.681	**0.0**	**0.0**	**66.33**	**0.035**	**40.24**	**0.021**
Copper	**8157.95**	10.945	**0.0**	**0.0**	**6789.8**	**9.109**	**130.87**	**0.176**
Dioxin, furan	4.46E-04	0.371	0.0	0.0	4.46E-04	0.371	4.46E-04	0.371
Dinitrotoluene	0.83	0.029	0.0	0.0	0.83	0.029	0.83	11.620
Iron	47927.3	15.483	0.0	0.0	47927.39	15.483	47927.39	15.483
Manganese	709.88	0.067	0.0	0.0	709.88	0.067	709.88	0.067
Nickel	76.67	0.015	0.0	0.0	76.67	0.015	76.67	0.015
NNDAP	0.66	0.000	0.0	0.0	0.66	0.000	0.66	0.000
PAH	0.00067	0.000	0.0	0.0	0.00067	0.000	0.00067	0.000
Lead	**18136.3**	28.722	**0.0**	**0.0**	**1887.6**	**2.989**	**281.22**	**0.445**
Phthalate	0.068	0.000	0.0	0.0	0.068	0.000	0.068	0.000
RDX	1.47	0.044	0.0	0.0	1.47	0.044	1.47	0.044
Antimony	221.29	2.331	0.0	0.0	221.29	2.331	221.29	2.331
Selenium	1.76	0.074	0.0	0.0	1.76	0.074	1.76	0.074
Thallium	36.7	2.577	0.0	0.0	36.7	2.577	36.7	2.577
Zinc	**9330.3**	2.890	**0.0**	**0.0**	**6596.5**	**2.043**	**296.8**	**0.092**
HI (e)		67.291		0.00		38.013		35.658
RSA Multiplier (f)		2.369		0.00		1.338		1.256
% Risk Reduction (g)		NA		100%		44%		47%

(a) Risk calculated in SWERA (Rust E&I, 1997).
(b) Includes excavation of contaminated soil and backfilling clean soil in excavation.
(c) Soil concentration term.
(d) Hazard quotient.
(e) Hazard indices calculated as the sum of hazard quotients.
(f) Calculated as HI/RSA of 28.4.
(g) Risk reduction = (67.29-HI)/67.29.

TABLE B-4

Estimated Changes in Ecological Risk to Soil Fauna Receptors at SWMU 21

	Baseline Risk (a)		Corrective Measures Alternative					
	SWERA		1 – Asphalt Cover		3 – Soil Washing		2 and 4 – Solidification/ Stabilization and Off-Post Treatment/Disposal (b)	
	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)
Arsenic	13.12	0.219	0.000	0.000	13.12	0.219	13.12	0.219
Cadmium	**288.64**	**14.432**	**0.000**	**0.000**	**204.24**	**10.212**	**4.66**	**0.233**
Chromium	**1292.54**	**3231.350**	**0.000**	**0.000**	**66.33**	**165.825**	**40.24**	**100.600**
Copper	**8157.96**	**97.350**	**0.000**	**0.000**	**6789.8**	**81.024**	**130.87**	**1.562**
Iron	47927.39	47.927	0.000	0.000	47927.39	47.927	47927.39	47.927
Mercury	0.054	0.054	0.000	0.000	0.054	0.054	0.054	0.054
Nickel	76.67	0.383	0.000	0.000	76.67	0.383	76.67	0.383
PAH	0.519	0.010	0.000	0.000	0.519	0.003	0.519	0.003
Lead	**18136.34**	**29.928**	**0.000**	**0.000**	**1887.64**	**3.115**	**281.22**	**0.464**
Selenium	1.76	0.025	0.000	0.000	1.76	0.025	1.76	0.025
Zinc	**9330.26**	**46.651**	**0.000**	**0.000**	**6596.5**	**32.983**	**296.82**	**1.484**
HI (e)		3468.330		0.000		341.770		152.954
RSA Multiplier (f)		76.227		0.000		7.511		3.362
% Risk Reduction (g)		NA		100%		90%		96%

(a) Risk calculated in SWERA (Rust E&I, 1997).
(b) Includes excavation of contaminated soil and backfilling clean soil in excavation.
(c) Soil concentration term.
(d) Hazard quotient.
(e) Hazard indices calculated as the sum of hazard quotients.
(f) Calculated as HI/RSA of 45.5.
(g) Risk reduction = (3468.3-HI)/3468.3.

TABLE B-5

Estimated Changes in Ecological Risk to Plant Receptors at SWMU 21

	Baseline Risk (a)		Corrective Measures Alternative					
	SWERA		1 – Asphalt Cover		3 – Soil Washing		2 and 4 – Solidification/ Stabilization and Off-Post Treatment/Disposal (c)	
	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)
Silver	6.48	3.240	0.0	0.0	6.48	3.240	6.48	3.240
Arsenic	13.12	1.312	0.0	0.0	13.12	1.312	13.12	1.312
Barium	4021.07	8.042	0.0	0.0	4021.07	8.042	4021.07	8.042
Beryllium	1.2	0.120	0.0	0.0	1.2	0.120	1.2	0.120
Cadmium	**288.64**	**96.213**	**0.0**	**0.0**	**204.24**	**68.080**	**4.66**	**1.553**
Cobalt	6.37	0.319	0.0	0.0	6.37	0.319	6.37	0.319
Chromium/hexachrome	**1292.54**	**17.234**	**0.0**	**0.0**	**66.33**	**0.884**	**40.24**	**0.537**
Copper	**8157.95**	**81.580**	**0.0**	**0.0**	**6754.06**	**67.541**	**130.87**	**1.309**
Dinitrotoluene	0.82	0.001	0.0	0.0	0.82	0.001	0.82	0.001
Mercury	0.054	0.180	0.0	0.0	0.054	0.180	0.054	0.180
Manganese	709.88	1.420	0.0	0.0	709.88	1.420	709.88	1.420
Nickel	76.67	0.307	0.0	0.0	76.67	0.307	76.67	0.307
PAH	0.45	0.018	0.0	0.0	0.45	0.018	0.45	0.018
Lead	**18136.34**	**36.713**	**0.0**	**0.0**	**1887.64**	**3.821**	**281.22**	**0.569**
Phthalate	1.4	0.014	0.0	0.0	1.4	0.014	1.4	0.014
Antimony	221.29	44.258	0.0	0.0	221.29	44.258	221.29	44.258
Selenium	1.76	1.760	0.0	0.0	1.76	1.760	1.76	1.760
Thallium	36.72	36.720	0.0	0.0	36.72	36.720	36.72	36.720
Zinc	**9330.26**	**186.605**	**0.0**	**0.0**	**6596.5**	**131.930**	**296.8**	**5.936**
HI (e)		516.055		0.0		369.966		107.614
RSA Multiplier (f)		12.587		0.0		9.024		2.625
% Risk Reduction (g)		NA		100%		28%		79%

(a) Risk calculated in SWERA (Rust E&I, 1997).
(b) Includes excavation of contaminated soil and backfilling clean soil in excavation.
(c) Soil concentration term.
(d) Hazard quotient.
(e) Hazard indices calculated as the sum of Hazard Quotients.
(f) Calculated as HI/RSA of 41.
(g) Risk Reduction = (516.05-HI)/516.05.

Table B-6. Post Corrective Measures COPC Concentrations in Soil at SWMU 42 (1)

	Soil Cover (or backfilled soil) Corrective Measures 1, 2, and 4							Soil Washing Corrective Measure 3						
Sample ID	Pb	Ba	Cr	Cu	Tl	Sb	Zn	Pb	Ba	Cr	Cu	Tl	Sb	Zn
EP-42-001A (0.5)	328	251	7.28	85.4	3.31	3.57	53.8	328	251	7.28	85.4	3.31	3.57	53.8
SB-42-001 (0)	91.9	95.3	30.2	41	3.31	3.57	435	91.9	95.3	30.2	41	3.31	3.57	435
SB-42-001 (2)	28	35.4	7.36	16.7	3.31	3.57	85.7	28	35.4	7.36	16.7	3.31	3.57	85.7
SB-42-002 (0)	26.8	218	11.3	13.2	3.31	3.57	52.7	26.8	218	11.3	13.2	3.31	3.57	52.7
SB-42-002 (2)	55.1	79.9	8.32	24.3	3.31	3.57	98.6	55.1	79.9	8.32	24.3	3.31	3.57	98.6
SB-42-003 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	861	11.37	6267	30.78	324.9	2439
SB-42-003 (2)	96.7	291	23	39.9	54.4	1.45	137	1800	1410	12.12	3000	24	297	5940
SB-42-004 (0)	89.2	68.2	7.62	19	3.31	3.57	62.8	89.2	68.2	7.62	19	3.31	3.57	62.8
SB-42-004 (2)	8.5	34.5	8.97	5.62	3.31	3.57	15.8	8.5	34.5	8.97	5.62	3.31	3.57	15.8
SB-42-005 (0)	367	334	10.7	23.1	3.31	35.9	53.6	367	334	10.7	23.1	3.31	35.9	53.6
SB-42-005 (2)	33.4	67.4	13.1	6.99	3.31	3.57	18.8	33.4	67.4	13.1	6.99	3.31	3.57	18.8
SB-42-006 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	10200	84	3420	32.94	319.2	936
SB-42-006 (2)	1380	783	15.5	192	8.82	35.1	61.6	1380	783	15.5	192	8.82	35.1	61.6
SB-42-007 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	7800	57.42	2340	22.08	292.2	636
SB-42-007 (2)	96.7	291	23	39.9	54.4	1.45	137	1800	26400	14.16	4200	15.66	166.8	906
SB-42-008 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	5280	73.8	1320	9.96	155.4	552.6
SB-42-008 (2)	210	244	31.9	38.5	3.31	9.81	33.2	210	244	31.9	38.5	3.31	9.81	33.2
SB-42-009 (0)	42.7	88.3	9.76	13.8	3.31	3.57	45.1	42.7	88.3	9.76	13.8	3.31	3.57	45.1
SB-42-009 (2)	20.55	56.55	7.34	6.855	3.31	3.57	21.3	20.55	56.55	7.34	6.855	3.31	3.57	21.3
SB-42-010 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	3000	42.18	816	9.18	103.2	636
SB-42-010 (2)	130	159	10.1	25.7	3.31	3.57	31.4	130	159	10.1	25.7	3.31	3.57	31.4
SB-42-011 (0)	60	73.8	9.55	15.5	3.31	3.57	56.1	60	73.8	9.55	15.5	3.31	3.57	56.1
SB-42-011 (2)	16	48.2	14	6.91	3.3	3.57	23.3	16	48.2	14	6.91	3.3	3.57	23.3
SB-42-012 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	972	15.84	331.8	7.56	64.8	226.8
SB-42-012 (2)	96.7	291	23	39.9	54.4	1.45	137	1800	377.4	7.98	145.8	1.986	30.54	81.6
SB-42-013 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	9600	97.8	1656	14.22	269.4	870
SB-42-013 (2)	96.7	291	23	39.9	54.4	1.45	137	1800	1452	20.64	207	1.986	36.18	151.8
SB-42-017A (2)	96.7	291	23	39.9	54.4	1.45	137	1800	15000	97.2	3900	90	355.8	3258
SB-42-018A (0)	50.45	113.5	14.45	17.95	10.29	3.57	61.95	50.45	113.5	14.45	17.95	10.29	3.57	61.95
SB-42-019A (0)	56.1	130	13.1	18.5	11.4	3.57	50.4	56.1	130	13.1	18.5	11.4	3.57	50.4
SB-42-020A (0)	142	59.9	8.58	14.2	11.4	3.57	34.7	142	59.9	8.58	14.2	11.4	3.57	34.7
SB-42-021A (0)	17.4	66.8	9.04	9.61	12.3	3.57	30.2	17.4	66.8	9.04	9.61	12.3	3.57	30.2
SB-42-022A (0)	97.2	79.6	11.5	19.6	10.5	3.57	72.9	97.2	79.6	11.5	19.6	10.5	3.57	72.9
SB-42-023A (0)	23.8	84.1	11.5	13.1	3.31	3.57	49.4	23.8	84.1	11.5	13.1	3.31	3.57	49.4
SB-42-024A (0)	56.4	64.9	8.54	14.6	3.31	3.57	44.8	56.4	64.9	8.54	14.6	3.31	3.57	44.8
SB-42-025A (0)	16.5	81	10.8	8.97	3.31	3.57	41.1	16.5	81	10.8	8.97	3.31	3.57	41.1
SB-42-026A (0)	549	481	12.8	95.3	5.22	3.57	150	549	481	12.8	95.3	5.22	3.57	150
SB-42-027A (0)	48.7	75.9	8.96	16.7	3.31	3.57	52.3	48.7	75.9	8.96	16.7	3.31	3.57	52.3
SB-42-028A (0)	21.2	73.8	6.91	9.88	3.31	3.57	31.5	21.2	73.8	6.91	9.88	3.31	3.57	31.5
SB-42-029A (0)	36.9	106	14.2	16.2	7.99	3.57	56.6	36.9	106	14.2	16.2	7.99	3.57	56.6
SB-42-030A (0)	37.7	78.3	10.1	19.3	13.5	3.57	43.3	37.7	78.3	10.1	19.3	13.5	3.57	43.3

Table B-6 (Continued)

	Soil Cover (or backfilled soil) Corrective Measures 1, 2, and 4							Soil Washing Corrective Measure 3						
Sample ID	Pb	Ba	Cr	Cu	Tl	Sb	Zn	Pb	Ba	Cr	Cu	Tl	Sb	Zn
SB-42-031A (0)	119	135	12.3	29.6	10.2	3.57	70.5	119	135	12.3	29.6	10.2	3.57	70.5
SB-42-032A (0)	1160	442	17.3	137	13.7	15.6	294	1160	442	17.3	137	13.7	15.6	294
SB-42-033A (0)	53.45	1033.5	14.2	15.35	10.55	3.57	58.9	53.45	1033.5	14.2	15.35	10.55	3.57	58.9
SB-42-034A (0)	37.8	82.1	14.9	12.2	19.2	3.57	44.5	37.8	82.1	14.9	12.2	19.2	3.57	44.5
SB-42-035A (0)	46.8	58.5	16	16.5	8.21	3.57	59.3	46.8	58.5	16	16.5	8.21	3.57	59.3
SB-42-036A (0)	37.6	81.6	12	13.3	11.5	3.57	47.5	37.6	81.6	12	13.3	11.5	3.57	47.5
SB-42-037A (0)	9.79	104.5	10.87	7.26	20.4	3.57	28.35	9.79	104.5	10.87	7.26	20.4	3.57	28.35
SB-42-038A (0)	22	122	14.3	13.2	15	3.57	50	22	122	14.3	13.2	15	3.57	50
SB-42-039A (0)	64	86.2	12	20.4	7.92	3.57	56.7	64	86.2	12	20.4	7.92	3.57	56.7
SB-42-041A (0)	58.5	111	14.6	15.4	3.31	3.57	48.6	58.5	111	14.6	15.4	3.31	3.57	48.6
SB-42-042A (0)	251	158	15.8	25.6	3.31	3.57	98.5	251	158	15.8	25.6	3.31	3.57	98.5
SB-42-043A (0)	44.7	96.2	12.5	10.4	3.31	3.57	37.4	44.7	96.2	12.5	10.4	3.31	3.57	37.4
SB-42-044A (0)	33	76.6	11	10.9	3.31	3.57	46.7	33	76.6	11	10.9	3.31	3.57	46.7
SB-42-045A (0)	83.5	71.5	11.1	13.5	3.31	3.57	43.5	83.5	71.5	11.1	13.5	3.31	3.57	43.5
SB-42-046A (0)	185	748	9.31	285	6.47	3.57	38.3	185	748	9.31	285	6.47	3.57	38.3
SB-42-047A (0)	113	457	17.8	31.6	3.31	3.57	90.6	113	457	17.8	31.6	3.31	3.57	90.6
SB-42-048A (0)	295	133	41.9	70.8	5.35	3.57	257	295	133	41.9	70.8	5.35	3.57	257
SB-42-049A (0)	360	112	33.65	918.5	5.66	3.57	336	360	112	33.65	918.5	5.66	3.57	336
SB-42-050A (0.5)	96.7	291	23	39.9	54.4	1.45	137	1800	426.6	31.974	1281.15	4.446	180.06	147.18
SB-42-050B(1)	96.7	291	23	39.9	54.4	1.45	137	1800	112.2	13.8	120.6	1.986	19.26	41.88
SB-42-051A (0)	170	372	6.81	1450	6.74	3.57	388	170	372	6.81	1450	6.74	3.57	388
SB-42-051B (2)	39	58.4	8.47	27	5.56	3.57	26.2	39	58.4	8.47	27	5.56	3.57	26.2
SS-42-001 (0)	16.3	55.1	9.64	7.59	3.31	3.57	52.3	16.3	55.1	9.64	7.59	3.31	3.57	52.3
SS-42-002 (0)	81.5	102	13.8	19	3.31	3.57	61.5	81.5	102	13.8	19	3.31	3.57	61.5
SS-42-003 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	21000	178.8	12600	120	3180	3000
SS-42-004 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	18000	145.8	13800	96	1980	2880
SS-42-005 (0)	1055	219.5	9.71	60.45	7.62	11.62	104.55	1055	219.5	9.71	60.45	7.62	11.62	104.55
SS-42-006 (0)	346	160	15.3	60.4	10.2	3.57	130	346	160	15.3	60.4	10.2	3.57	130
SS-42-007 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	14400	475.8	7200	51.84	666	1986
SS-42-008 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	10800	349.2	4560	41.22	523.2	2298
SS-42-009 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	407.4	7.68	116.4	1.986	7.2	175.2
SS-42-010 (0)	292	477	11.4	58.2	3.31	3.57	134	292	477	11.4	58.2	3.31	3.57	134
SS-42-011 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	4500	75.6	106.8	9.84	57.24	1284
SS-42-012 (0)	361	143	11.4	98	3.31	3.57	204	361	143	11.4	98	3.31	3.57	204
SS-42-013 (0)	96.7	291	23	39.9	54.4	1.45	137	1800	275.4	511.2	270	6.3	9.9	888
SS-42-014 (0)	139	71.3	10.5	91.4	3.31	3.57	89.2	139	71.3	10.5	91.4	3.31	3.57	89.2
SS-42-015 (0)	128	121	11.9	35.2	3.31	3.57	121	128	121	11.9	35.2	3.31	3.57	121
SS-42-016 (0)	354	3200	13.1	350	3.31	3.57	239	354	3200	13.1	350	3.31	3.57	239
ES1-94-01	17.2	15	1.22	26.9		2.35	8.46	17.2	15	1.22	26.9		2.35	8.46
ES1-94-02	736.5	461	10.9	131.5		341	58.6	736.5	461	10.9	131.5		341	58.6
ES1-94-03	499	318	7.44	87.5		94	45.4	499	318	7.44	87.5		94	45.4

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Table B-6 (Continued)

	Soil Cover (or backfilled soil) Corrective Measures 1, 2, and 4							Soil Washing Corrective Measure 3						
Sample ID	Pb	Ba	Cr	Cu	Tl	Sb	Zn	Pb	Ba	Cr	Cu	Tl	Sb	Zn
ES1-94-04	173	128	3.19	27.7		88.5	12.5	173	128	3.19	27.7		88.5	12.5
ES1-94-05	299	312	18.5	65		35.9	92.4	299	312	18.5	65		35.9	92.4
ES1-94-06	532	352	7.7	98.5		113	51.2	532	352	7.7	98.5		113	51.2
ES1-94-07	392	203	15.6	53.6		6.9	117	392	203	15.6	53.6		6.9	117
ES1-94-08	456	260	6.81	82.3		90.2	40.7	456	260	6.81	82.3		90.2	40.7
ES1-94-09	822	623	18.9	133		352	124	822	623	18.9	133		352	124
Count	94	90	90	90	81	90	90	94	90	90	90	81	90	90
Mean	181.29	250.03	15.12	71.09	19.08	16.49	97.17	587.76	1910.97	36.04	830.42	12.14	118.86	397.82
Dev.	250.91	364.17	7.24	183.46	21.70	54.55	78.32	725.66	4824.97	83.52	2323.95	20.18	407.90	906.87
t-Value	1.6611	1.6611	1.6611	1.6611	1.6611	1.6611	1.6611	1.6611	1.6611	1.6611	1.6611	1.6611	1.6611	1.6611
Std. Error	42.99	63.76	1.27	32.12	4.01	9.55	13.71	124.33	844.83	14.62	406.91	3.73	71.42	158.79
UCL	**224.28**	**313.79**	**16.39**	**103.22**	**23.09**	**26.05**	**110.89**	**712.09**	**2755.80**	**50.67**	**1237.33**	**15.86**	**190.28**	**556.61**
Min	8.5	34.5	6.81	5.62	3.3	1.45	15.8	8.5	34.5	6.81	5.62	1.986	3.57	15.8
Max	1380	3200	41.9	1450	54.4	35.9	435	1800	26400	511.2	13800	120	3180	5940

(1) All concentrations presented in mg/kg (ppm).

TABLE B-7

Estimated Changes in Ecological Risk to Passerine Bird Receptors at SWMU 42

	Baseline Risk (a)		Corrective Measure Alternative			
	SWERA		1, 2, and 4 – Soil Cover or Backfill (b)		3 – Soil Washing	
Analyte	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)
Silver	6.87	0.40	6.87	0.40	6.87	0.40
Arsenic	21.92	1.13	21.92	0.13	21.92	1.13
Barium	**7082.92**	**52.57**	**313.79**	**2.33**	**2760.53**	**20.49**
Beryllium	0.53	0.00	0.526	0.00	0.53	0.00
Cadmium	10.58	11.72	10.58	11.72	10.58	11.72
Cobalt	5.88	0.01	5.88	0.01	5.88	0.01
Chromium/hexachrome	**90.59**	**50.17**	**16.39**	**9.07**	**50.75**	**28.11**
Copper	**3107.12**	**40.45**	**103.22**	**1.34**	**1239.61**	**16.14**
DDT_R (e)	1.25	14.04	1.25	14.04	1.25	14.04
Dioxin, furan	3.86E-06	18.83	3.86E-06	18.83	3.86E-06	18.83
Iron	18083.61	33.39	18083.61	33.39	18083.61	33.39
Mercury	0.07	0.02	0.065	0.02	0.07	0.02
Manganese	281.06	0.49	281.06	0.49	281.06	0.49
Nickel	40.12	0.99	40.12	0.99	40.12	0.99
Lead	**11110.80**	**551.71**	**224.28**	**11.14**	**712.09**	**35.36**
Phthalate	0.59	0.04	0.59	0.04	0.59	0.04
Thallium	**24.07**	**68.32**	**23.09**	**66.49**	**15.89**	**45.76**
Zinc	**1230.64**	**32.82**	**110.89**	**2.96**	**557.50**	**14.87**
HI (f)		878.1		174.4		241.8
RSA Multiplier (g)		9.7		1.9		2.7
Risk Reduction (h)		NA		80%		72%

(a) Risk calculated in SWERA (Rust E&I, 1997).
(b) Alternative 1 includes a soil cover; Alternatives 2 and 4 include the placement of clean backfill in the excavated area.
(c) Soil concentration term.
(d) Hazard quotient.
(e) Sum of DDD, DDE and DDT.
(f) Hazard indices calculated as the sum of hazard quotients.
(g) Calculated as HI/RSA HI of 90.2.
(h) Risk reduction = (878.1-HI)/878.1.

TABLE B-8

Estimated Changes in Ecological Risk to Deer Mouse Receptors at SWMU 42

	Baseline Risk (a)		Corrective Measure Alternative			
	SWERA		1, 2, and 4 – Soil Cover or Backfill (b)		3 – Soil Washing	
Analyte	**C_{term} (c)**	**HQ (d)**	**C_{term} (c)**	**HQ (d)**	**C_{term} (c)**	**HQ (d)**
Silver	6.87	0.00	6.87	0.00	6.87	0.00
Arsenic	21.92	0.15	21.92	0.15	21.92	0.15
Barium	**7082.92**	**15.83**	**314.15**	**0.70**	**2760.53**	**6.17**
Beryllium	0.53	0.00	0.53	0.00	0.53	0.00
Cadmium	10.58	0.11	10.58	0.11	10.58	0.11
Cobalt	5.88	0.65	5.88	0.65	5.88	0.65
Chromium/hexachrome	**90.58**	**0.20**	**16.39**	**0.04**	**50.75**	**0.11**
Copper	**3107.12**	**17.51**	**103.39**	**0.58**	**1239.61**	**6.99**
DDT_R (e)	1.25	0.01	1.25	0.01	1.25	0.01
Dioxin, furan	3.86E-06	11.62	3.86E-06	11.62	3.86E-06	11.62
Dinitrotoluene	4.35	0.64	4.35	0.64	4.35	0.64
Iron	18083.61	24.55	18083.61	24.55	18083.61	24.55
Mercury	0.065	0.00	0.065	0.00	0.065	0.00
Manganese	281.06	0.11	281.06	0.11	281.06	0.11
Nickel	40.12	0.03	40.12	0.03	40.12	0.03
PAH	1.75	0.01	1.75	0.01	1.75	0.01
Lead	**11110.8**	**73.93**	**225.23**	**1.50**	**714.82**	**4.76**
Phthalate	0.59	0.00	0.59	0.00	0.59	0.00
Antimony	**330.84**	**14.64**	**26.1**	**1.15**	**190.68**	**8.44**
Thallium	**24.07**	**7.10**	**23.11**	**6.82**	**15.89**	**4.69**
Zinc	**1230.64**	**1.60**	**110.96**	**0.14**	**557.5**	**0.73**
HI (f)		168.7		48.8		69.8
RSA Multiplier (g)		5.9		1.7		2.5
Risk Reduction (h)		NA		71%		59%

(a) Risk calculated in SWERA (Rust E&I, 1997).
(b) Alternative 1 includes a soil cover; Alternatives 2 and 4 include the placement of clean backfill in the excavated area.
(c) Soil concentration term.
(d) Hazard quotient.
(e) Sum of DDD, DDE, and DDT.
(f) Hazard indices calculated as the sum of hazard quotients.
(g) Calculated as HI/RSA HI of 28.4.
(h) Risk reduction = (168.7-HI)/168.7.

TABLE B-9

Estimated Changes in Ecological Risk to Jackrabbit Receptors at SWMU 42

	Baseline Risk (a)		Corrective Measure Alternative			
	SWERA		1, 2, and 4 – Soil Cover or Backfill (b)		3 – Soil Washing	
Analyte	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)
Silver	6.87	0.00	6.87	0.00	6.87	0.00
Arsenic	21.92	0.04	21.92	0.04	21.92	0.04
Barium	**7082.92**	**4.18**	**314.15**	**0.19**	**2760.53**	**1.63**
Beryllium	0.53	0.00	0.53	0.00	0.53	0.00
Cadmium	10.58	0.03	10.58	0.03	10.58	0.03
Cobalt	5.88	0.16	5.88	0.16	5.88	0.16
Chromium/hexachrome	**90.58**	**0.03**	**16.39**	**0.01**	**50.75**	**0.02**
Copper	**3107.12**	**2.77**	**103.39**	**0.09**	**1239.61**	**1.10**
DDT_R (e)	1.25	0.00	1.25	0.00	1.25	0.00
Dioxin, furan	3.86E-06	3.00	3.86E-06	0.03	3.86E-06	0.03
Dinitrotoluene	4.35	0.10	4.35	0.10	4.35	0.10
Iron	18083.61	6.47	18083.61	6.47	18083.61	6.47
Mercury	0.065	0.00	0.065	0.00	0.065	0.00
Manganese	281.06	0.03	281.06	0.03	281.06	0.03
Nickel	40.12	0.01	40.12	0.01	40.12	0.01
PAH	1.75	0.00	1.75	0.00	1.75	0.00
Lead	**11110.80**	**19.42**	**225.23**	**0.39**	**714.82**	**1.25**
Phthalate	0.59	0.00	0.59	0.00	0.59	0.00
Antimony	**330.84**	**3.85**	**26.1**	**0.30**	**190.68**	**2.22**
Thallium	**24.07**	**1.68**	**23.11**	**1.62**	**15.89**	**1.11**
Zinc	**1230.64**	**0.25**	**110.96**	**0.02**	**557.5**	**0.11**
HI (f)		42.0		9.5		17.3
RSA Multiplier (g)		4.4		1.0		1.8
Risk Reduction (h)		NA		77%		59%

(a) Risk calculated in SWERA (Rust E&I, 1997).
(b) Alternative 1 includes a soil cover; Alternatives 2 and 4 include the placement of clean backfill in the excavated area.
(c) Soil concentration term.
(d) Hazard quotient.
(e) Sum of DDD, DDE, and DDT.
(f) Hazard Indices calculated as the sum of Hazard Quotients.
(g) Calculated as HI/RSA HI of 9.5
(h) Risk Reduction = (42.025-HI)/42.025.

TABLE B-10

Estimated Changes in Ecological Risk to Soil Fauna Receptors at SWMU 42

	Baseline Risk (a)		Corrective Measure Alternative			
	SWERA		1, 2, and 4 – Soil Cover or Backfill (b)		3 – Soil Washing	
Analyte	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)
Arsenic	21.9	0.37	21.9	0.37	21.9	0.37
Cadmium	10.58	0.53	10.58	0.53	10.58	0.53
Chromium/hexachrome	**90.58**	**226.45**	**16.39**	**40.98**	**50.75**	**126.88**
Copper	**3107.12**	**37.08**	**103.39**	**1.23**	**1239.61**	**14.79**
DDT-R (e)	1.25	0.01	1.25	0.01	1.25	0.01
Iron	18083.61	18.08	18083.61	18.08	18083.61	18.08
Mercury	0.065	0.07	0.065	0.07	0.065	0.07
Nickel	40.12	0.20	40.12	0.20	40.12	0.20
PAH	1.75	0.01	1.75	0.01	1.75	0.01
Lead	**11110.8**	**18.33**	**225.23**	**0.37**	**714.82**	**1.18**
Zinc	**1230.64**	**6.15**	**110.96**	**0.55**	**557.5**	**2.79**
HI (f)		307.3		62.4		164.9
RSA Multiplier (g)		6.8		1.4		3.6
Risk Reduction (h)		NA		80%		46%

(a) Risk calculated in SWERA (Rust E&I, 1997).
(b) Alternative 1 includes a soil cover; Alternatives 2 and 4 include the placement of clean backfill in the excavated area.
(c) Soil concentration term.
(d) Hazard quotient.
(e) Summ of DDD, DDE, and DDT.
(f) Hazard indices calculated as the sum of hazard quotients.
(g) Calculated as HI/RSA HI of 45.5.
(h) Risk reduction = (307.275-HI)/307.275.

TABLE B-11

Estimated Changes in Ecological Risk to Plant Receptors at SWMU 42

	Baseline Risk (a)		Corrective Measure Alternative			
	SWERA		1, 2, and 4 – Soil Cover or Backfill (b)		3 – Soil Washing	
Analyte	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)	C_{term} (c)	HQ (d)
Silver	6.87	3.44	6.87	3.44	6.87	3.44
Arsenic	21.92	2.19	21.92	2.19	21.92	2.19
Barium	**7082.92**	**14.17**	**314.15**	**0.63**	**2760.53**	**5.52**
Beryllium	0.53	0.05	0.53	0.05	0.53	0.05
Cadmium	10.58	3.53	10.58	3.53	10.58	3.53
Cobalt	5.88	0.29	5.88	0.29	5.88	0.29
Chromium/hexachrome	**90.58**	**1.21**	**16.39**	**0.22**	**50.75**	**0.68**
Copper	**3107.12**	**31.07**	**103.39**	**1.03**	**1239.61**	**12.40**
Dinitrotoluene	1.25	0.00	1.25	0.00	1.25	0.00
Mercury	0.065	0.22	0.065	0.22	0.065	0.22
Manganese	281.06	0.56	281.06	0.56	281.06	0.56
Nickel	40.12	0.16	40.12	0.16	40.12	0.16
PAH	1.75	0.07	1.75	0.07	1.75	0.07
Lead	**11110.8**	**22.49**	**225.23**	**0.46**	**714.82**	**1.45**
Phthalate	0.59	0.00	0.59	0.00	0.59	0.00
Antimony	**330.84**	**66.17**	**26.1**	**5.22**	**190.68**	**38.14**
Thallium	**24.07**	**24.07**	**23.11**	**23.11**	**15.89**	**15.89**
Zinc	**1230.64**	**24.61**	**110.96**	**2.22**	**557.5**	**11.15**
HI (e)		194.3		43.4		95.7
RSA Multiplier (f)		4.7		1.1		2.3
Risk Reduction (g)		NA		78%		51%

(a) Risk calculated in SWERA (Rust E&I, 1997).
(b) Alternative 1 includes a soil cover; Alternatives 2 and 4 include the placement of clean backfill in the excavated area.
(c) Soil concentration term.
(d) Hazard quotient.
(e) Hazard indices calculated as the sum of hazard quotients.
(f) Calculated as HI/RSA HI of 41.
(g) Risk reduction = (194.302-HI)/194.302.

EXHIBIT B-1

Summary of Corrective Measures Risk Reductions for SWMU 21

Receptor of Concern	Risk Values (a)	SWERA Baseline Risks	Corrective Measure		
			Alternative 1: Asphalt Cover and Land Use Restrictions	Alternative 3: Excavation, Soil Washing, and Land Use Restrictions	Alternatives 2 and 4: Excavation, Solidification/ Stabilization or Off-Post Treatment/ Disposal, and Land Use Restrictions
Passerine birds	RSA multiplier	11.6	0	3.92	1.29
	% risk reduction	NA (b)	100	66	89
Deer mice	RSA multiplier	2.37	0	1.33	1.25
	% risk reduction	NA	100	44	47
Soil fauna	RSA multiplier	76.2	0	7.50	3.36
	% risk reduction	NA	100	90	96
Plants	RSA multiplier	12.5	0	9.02	2.62
	% risk reduction	NA	100	28	79

(a) Risk multiplier = ratio of the post-corrective measures HI to the RSA HI.
Percent risk reduction = percent reduction in value of the post-corrective measures HI compared to the baseline value for SWMU 21.

(b) Not applicable.

EXHIBIT B-2

Summary of Corrective Measures Risk Reductions for SWMU 22

Receptor of Concern	Risk Values (a)	SWERA Baseline Risks	Corrective Measure			
			Alternative 1: Soil Cover, Fence, and Land Use Restrictions	Alternative 2: Excavation, Solidification/ Stabilization, and Land Use Restrictions	Alternative 3: Excavation, Soil Washing, and Land Use Restrictions	Alternative 4: Excavation, Off-Post Treatment/ Disposal, and Land Use Restrictions
Passerine birds	RSA multiplier	9.7	1.9	1.9	2.7	1.9
	% risk reduction	NA (b)	80	80	72	80
Deer mice	RSA multiplier	5.9	1.7	1.7	2.5	1.7
	% risk reduction	NA	71	71	59	71
Jackrabbit	RSA multiplier	4.4	1.0	1.0	1.8	1.0
	% risk reduction	NA	77	77	59	77
Soil fauna	RSA multiplier	6.8	1.4	1.4	3.6	1.4
	% risk reduction	NA	80	80	46	80
Plants	RSA multiplier	4.7	1.1	1.1	2.3	1.1
	% risk reduction	NA	78	78	51	78

(a) Risk multiplier = ratio of the post-corrective measures HI to the RSA HI.
Percent risk reduction = percent reduction in value of the post-corrective measures HI compared to the baseline value for SWMU 21.
(b) Not applicable.

APPENDIX C

Cost Estimates for Unrestricted Use Corrective Measures

Cost Estimates for Unrestricted Use Corrective Measures

Recent Army guidance focuses on the application of institutional controls (ICs) at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites. The guidance is presented in the memorandum “Army Guidance on Using Institutional Controls in the CERCLA Process,” issued on September 4, 1998, by the Assistant Chief of Staff for Installation Management, Department of the Army (U.S. Army, 1998). Although the guidance is primarily directed to ICs in relation to Base Realignment and Closure (BRAC) transfers, it also presents general principles applicable to active military installations. Appendix E of the CMS Work Plan (Dames & Moore, 2000) provides a brief explanation of the Army policy regarding ICs and implements the guidance at selected Group A solid waste management units (SWMUs).

To comply with the recent Army guidance, a corrective measure that remediates a site so that it is suitable for unrestricted use is evaluated for SWMUs 1b, 1c, 37, 45, and 48 in the CMS Work Plan. This corrective measure includes excavation of contaminated soil and off-post treatment/disposal. This applies to all soil that:

- Contains COCs at concentrations above residential CAOs.
- Poses a cancer risk above 1×10^{-6}.
- Poses a noncancer hazard index (HI) greater than 1.0.
- Results in a blood lead level above 10 micrograms per deciliter (μg/dL) for children (11.1 μg/dL for adults).

The excavation and off-post treatment/disposal corrective measure includes provisions for confirmation sampling to ensure that the soil contaminated at levels above CAOs is removed.

The objective of the following evaluation is primarily to compare long-term costs of remediation versus ICs.

C.1 BURN PAD (SWMU 1b)

C.1.1 COST COMPARISON

No corrective action is recommended for the Burn Pad.

C.1.2 SUMMARY

- Based on a comparison between the maximum detected concentrations of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) and CAOs, no COCs are identified at the Burn Pad that require corrective action.

- Although human health cancer risks and noncancer health effects exceed State of Utah goals, the risk is almost wholly due to the produce ingestion exposure pathway. Because of the excessive uncertainty associated with this pathway, it is not considered in the calculation of CAOs. Therefore, it is recommended that corrective action not be based on the highly speculative produce ingestion pathway.

- It is recommended that unrestricted use be permitted for SWMU 1b; no corrective action is required.

C.2 TRASH BURN PITS (SWMU 1c)

C.2.1 COST COMPARISON

The estimated cost of implementing excavation and off-post treatment/disposal without ICs for 4,700 yd^3 of contaminated soil at the Trash Burn Pits is $2,880,000. Table C-1 presents the detailed cost estimate. The estimated cost of implementing an alternative with ICs (Alternative 1, land use restrictions, Table A-2) is $12,000. See Appendix A for that cost table.

C.2.2 SUMMARY

- Based on a comparison between the maximum detected concentration of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) and CAOs and EPCs, RDX is identified as the only residential COC at the Trash Burn Pits that requires corrective action to allow for unrestricted use.

- A review of the human health RA conducted in the Phase II RFI indicates that RDX also poses unacceptable residential human health risks.

- Based on an evaluation of locations where RDX detections exceed CAOs, it is estimated that 4,700 yd^3 of soil requires corrective action to allow for unrestricted use of SWMU 1c.

- The cost of implementing land use restrictions ($12,000) is less than the cost of excavation and off-post treatment/disposal ($2,880,000).

Table C-1: SWMU 1c - Alternative 1: *Excavation and Off-Post Treatment/Disposal* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Mobilization/demobilization	1	ls	10,000.00	10,000
UXO Clearance	14,100	sy	10.00	141,000
Ground Preparation/Clearing	14,100	sy	0.20	2,900
Soil Excavation	4,700	cy	20.00	94,000
Backfilling Clean Soil	4,700	cy	10.00	47,000
Confirmation Sampling	200	sample	350.00	70,000
Soil Profile and Analytical Costs	47	sample	1,300.00	61,100
Transport to TSDF/Landfill	4,700	cy	70.00	329,000
TSDF/Subtitle C Landfill Disposal Cost	6,600	ton	145.00	957,000
Grading	127	msf	48.00	6,100
Revegetation/Seeding	14,100	sy	0.22	3,200
Subtotal Direct Capital Costs				1,711,300
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				342,300
Health and Safety Equipment & Training (5% of direct costs)				85,600
Legal and Administrative (5% of direct costs)				85,600
Project Management (10% of direct costs)				171,200
Subtotal Indirect Capital Costs				684,700
Total Capital Costs				2,396,000
Subtotal Cost of Alternative				2,396,000
Contingency (@ 20%)				479,200
Total Cost of Alternative				2,880,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample

C.3 CONTAMINATED WASTE PROCESSING PLANT (SWMU 37)

C.3.1 COST COMPARISON

The estimated cost of implementing excavation and off-post treatment/disposal without ICs for 540 yd^3 of contaminated soil at the Contaminated Waste Processing Plant is $320,000. Table C-2 presents the detailed cost estimate. The estimated cost of implementing an alternative with ICs (Alternative 1, land use restrictions, Table A-15) is $12,000. See Appendix A for that cost table.

C.3.2 SUMMARY

- Based on a comparison between the maximum detected concentrations of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) and CAOs and EPCs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and dioxins/furans are identified as the residential COCs at the Contaminated Waste Processing Plant that require corrective action to allow for unrestricted use.

- A review of the human health RA conducted in the Phase II RFI indicates that benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno (1,2,3-cd)pyrene, dioxins/furans, and TNT pose unacceptable human health risks. However, TNT poses cancer and noncancer risks via the produce ingestion exposure pathway. Because of the excessive uncertainty associated with this pathway, it is not considered in the calculation of CAOs. Therefore, it is recommended that corrective action not be based on the highly speculative produce ingestion pathway.

- Based on an evaluation of locations where benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, and dioxin/furans exceed their respective CAOs, it is estimated that 540 yd^3 of soil requires corrective action to allow for unrestricted use of SWMU 37.

- The cost of implementing land use restrictions ($12,000) is less than the cost of excavation and off-post treatment/disposal ($320,000).

C.4 STORMWATER DISCHARGE AREA (SWMU 45)

C.4.1 COST COMPARISON

The estimated cost of implementing excavation and off-post treatment/disposal without ICs for 4 yd^3 of contaminated soil at the Stormwater Discharge Area is $13,000. Table C-3 presents the detailed cost estimate. The estimated cost of implementing an alternative with ICs (Alternative 1, land use restrictions, Table A-20) is $12,000. See Appendix A for that cost table.

Table C-2: SWMU 37 - Alternative 1: ***Excavation and Off-Post Treatment/Disposal***
Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Mobilization/demobilization	1	ls	5,000.00	5,000
Ground Preparation/Clearing	1,610	sy	0.20	400
Soil Excavation	540	cy	20.00	10,800
Backfilling Clean Soil	540	cy	10.00	5,400
Confirmation Sampling	54	sample	290.00	15,700
Soil Profile and Analytical Costs	6	sample	1,300.00	7,800
Transport to TSDF/Landfill	540	cy	70.00	37,800
TSDF/Subtitle C Landfill Disposal Cost	760	ton	145.00	110,200
Grading	15	msf	48.00	800
Revegetation/Seeding	1,610	sy	0.22	400
Subtotal Direct Capital Costs				189,300
Indirect Capital Costs				
Engineering and Construction Management (20% of direct costs)				37,900
Health and Safety Equipment & Training (5% of direct costs)				9,500
Legal and Administrative (5% of direct costs)				9,500
Project Management (10% of direct costs)				19,000
Subtotal Indirect Capital Costs				75,900
Total Capital Costs				265,200
Subtotal Cost of Alternative				265,200
Contingency (@ 20%)				53,040
Total Cost of Alternative				320,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

Table C-3: SWMU 45 - Alternative 1: *Excavation and Off-Post Treatment/Disposal* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Mobilization/demobilization	1	ls	3,000.00	3,000
Ground Preparation/Clearing	11	sy	0.20	100
Soil Excavation	4	cy	20.00	100
Backfilling Clean Soil	4	cy	10.00	100
Confirmation Sampling	3	sample	175.00	600
Soil Profile and Analytical Costs	1	sample	1,300.00	1,300
Transport to TSDF/Landfill	4	cy	70.00	300
TSDF/Subtitle C Landfill Disposal Cost	6	ton	145.00	900
Grading	1	msf	48.00	100
Revegetation/Seeding	11	sy	0.22	100
Subtotal Direct Capital Costs				6,600
Indirect Capital Costs				
Engineering and Construction Management (30% of direct costs)				2,000
Health and Safety Equipment & Training (5% of direct costs)				400
Legal and Administrative (5% of direct costs)				400
Project Management (20% of direct costs)				1,400
Subtotal Indirect Capital Costs				4,200
Total Capital Costs				10,800
Subtotal Cost of Alternative				10,800
Contingency (@ 20%)				2,160
Total Cost of Alternative				13,000

Key to unit abbreviations

cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

C.4.2 SUMMARY

- Based on a comparison between the maximum detected concentration of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) and CAOs and EPCs, arsenic and lead are identified as the residential COCs at the Stormwater Discharge Area that require corrective action to allow for unrestricted use.

- A review of the human health RA conducted in the Phase II RFI indicates that arsenic also poses unacceptable residential human health risks. In addition, the blood lead model resulted in an exceedance of the CDC target level.

- Based on an evaluation of the location where arsenic and lead detections exceed CAOs, it is estimated that 4 yd^3 of soil requires corrective action to allow for unrestricted use of SWMU 45.

- The cost of implementing land use restrictions ($12,000) is slightly less than the cost of excavation and off-post treatment/disposal ($13,000).

C.5 OLD DISPENSARY DISCHARGE – BUILDING 400 (SWMU 48)

C.5.1 COST COMPARISON

The estimated cost of implementing excavation and off-post treatment/disposal without ICs for 15 yd^3 of contaminated soil at the Old Dispensary Discharge – Building 400 is $20,000. Table C-4 presents the detailed cost estimate. The estimated cost of implementing an alternative with ICs (Alternative 1, land use restrictions, Table A-21) is $12,000. See Appendix A for that cost table.

C.5.2 SUMMARY

- Based on a comparison between the maximum detected concentration of each COPC identified in the Phase II RFI Report (Montgomery Watson, 1997) and CAOs and EPCs, dieldrin is identified as the only residential COC for the Old Dispensary Discharge – Building 400 that requires corrective action to allow for unrestricted use.

- A review of the human health RA conducted in the Phase II RFI indicates that dieldrin also poses unacceptable human health risks.

- Based on an evaluation of the location where dieldrin exceeds its CAO, it is estimated that 15 yd^3 of soil requires corrective action to allow for unrestricted use of SWMU 48.

- The cost of implementing land use restrictions ($12,000) is less than the cost of excavation and off-post treatment/disposal ($20,000).

Table C-4: SWMU 48 - Alternative 1: *Excavation and Off-Post Treatment/Disposal* Cost Estimate

Item	Quantity	Unit	Unit Cost ($)	Total Cost ($)
Direct Capital Costs				
Mobilization/demobilization	1	ls	3,000.00	3,000
Ground Preparation/Clearing	11	sy	0.20	100
Soil Excavation	15	cy	20.00	300
Backfilling Clean Soil	15	cy	10.00	200
Confirmation Sampling	3	sample	215.00	700
Soil Profile and Analytical Costs	1	sample	1,300.00	1,300
Transport to TSDF/Landfill	15	cy	70.00	1,100
TSDF/Subtitle C Landfill Disposal Cost	21	ton	145.00	3,100
Grading	1	msf	48.00	100
Revegetation/Seeding	11	sy	0.22	100
Subtotal Direct Capital Costs				10,000
Indirect Capital Costs				
Engineering and Construction Management (30% of direct costs)				3,000
Health and Safety Equipment & Training (5% of direct costs)				500
Legal and Administrative (5% of direct costs)				500
Project Management (20% of direct costs)				2,000
Subtotal Indirect Capital Costs				6,000
Total Capital Costs				16,000
Subtotal Cost of Alternative				16,000
Contingency (@ 20%)				3,200
Total Cost of Alternative				20,000

Key to unit abbreviations	
cy	cubic yard
ls	lump sum
msf	thousand square feet
sample	per sample
sy	square yard
ton	per ton

APPENDIX D

Additional Data Collection Activities
SWMUs 20 and 21

CONTENTS

CONTENTS (cont'd)

FIGURES

TABLES

Additional Data Collection Activities
SWMUs 20 and 21

D.1 INTRODUCTION

D.1.1 PURPOSE AND SCOPE

This appendix presents the results of additional data collection activities at the AED Deactivation Furnace Site (SWMU 20) and the Deactivation Furnace Building (SWMU 21), Tooele Army Depot (TEAD), Tooele, Utah (Figure D-1). The field and laboratory work was performed in accordance with the Planning Document *Additional Data Collection Activities, SWMUs 2, 20, 21, and 23* (Dames & Moore, 1999), which described soil sampling activities designed to fill data gaps identified in the *Phase II Group A Resource Conservation and Recovery Act (RCRA) Facility Investigation* (RFI; Montgomery Watson, 1997).

The Planning Document *Additional Data Collection Activities* is the Second Addendum to the *Final Data Collection Quality Assurance Plan* (DCQAP; SEC Donohue, 1993) for the Known Releases SWMUs at TEAD. SWMUs 20 and 21 were included in the Second Addendum because the proposed sampling activities at these SWMUs were similar to those described in the Known Releases Planning Documents. Field investigation results for the Industrial Waste Lagoon (SWMU 2; Known Releases) and the Bomb and Shell Reconditioning Building (SWMU 23; Operable Unit 9) are reported in separate documents.

Of the eight Group A SWMUs at TEAD, SWMUs 20 and 21 were identified as requiring additional soil sampling to fill the following data gaps:

- SWMU 20 – Earthmoving activities were conducted after the collection of Phase II data. Additional samples were needed to define the current extent of contamination.

- SWMU 21 – Contamination was detected in nearly every surface soil sample collected at SWMU 21. Additional samples were needed to define the vertical and horizontal extent of contamination.

The goal of the field investigation was to collect additional data to complete the Corrective Measures Study (CMS). The results of the investigation are documented and evaluated in this appendix. Because additional sampling for SWMUs 20 and 21 was recommended by regulatory agencies after the CMS Work Plan was initially submitted, information from these evaluations is included in this CMS Report.

Analytes detected during this investigation are compared to the existing list of contaminants of potential concern (COPCs). In addition, the concentrations of COPCs are compared to the corrective action objectives (CAOs) presented in the CMS Work Plan (Dames & Moore, 2000) to determine whether they should be considered as contaminants of concern (COCs). The CMS Report summarizes these comparisons and the potential effects of the new data on the CMS Work Plan identification of corrective measures. As explained in this appendix, the additional data results did not identify any new COCs and are unlikely to significantly alter the results of the human health risk assessment (RA). Therefore, the RAs developed in the RFI are not revised. Likewise, the data collected as part of this field program are not used to supplement the Site-Wide Ecological RA (SWERA; Rust E&I, 1997b). The results of the additional field investigation support the CMS recommendations for each SWMU regarding the need for management measures or treatment technologies.

D.1.2 ORGANIZATION

This appendix is organized as follows:

- Procedures used to conduct field activities (Section D.2).
- Sampling and chemical results for SWMUs 20 and 21 (Sections D.3 and D.4).
- References (Section D.5).
- Soil boring logs, chains of custody, chemical data, and data quality assessment, respectively (Attachments A through D).

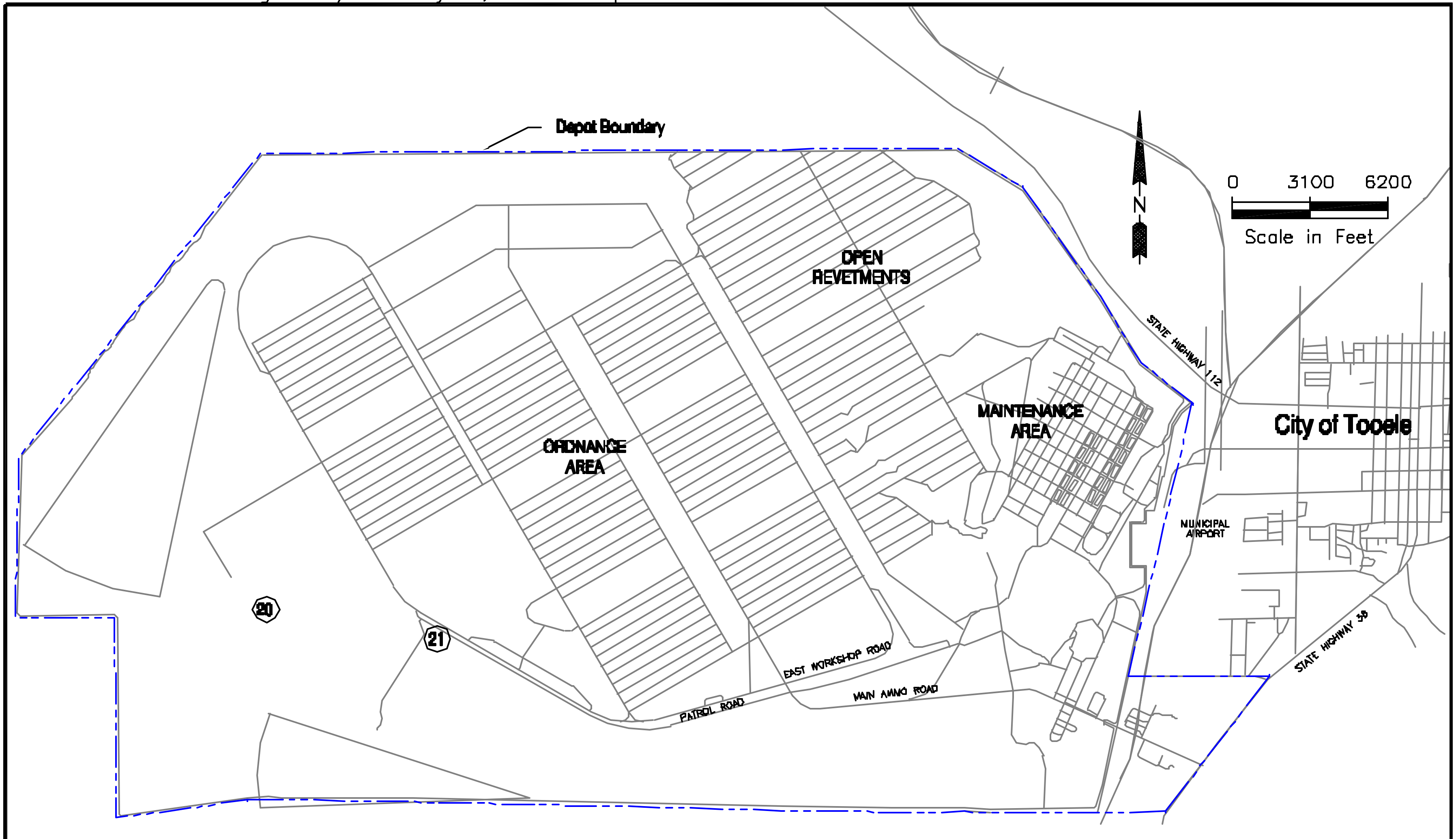
D.2 FIELD METHODS

D.2.1 FIELD INVESTIGATION AND PROCEDURES

Table D-1 summarizes the field program that is described in detail in Sections D.3 and D.4 of this report. The additional fieldwork was conducted to address previously identified data gaps. All work was performed in accordance with the Planning Documents; any deviations from the planned program are reported.

A total of 28 soil borings were advanced to depths of 3 feet (5 feet at one location) at selected locations within SWMUs 20 and 21. Soil samples from the borings included surface and subsurface soil for chemical analysis. An additional eight surface soil samples were also collected.

09604-056 File: FIGD-1.dwg Date/Time: May 26, 2000 1:05 p.m. Scale: 1=1 kdembin Xrefs:



LEGEND

(20) AED DEACTIVATION FURNACE SITE

(21) DEACTIVATION FURNACE BUILDING

SOURCE: RMS CORPORATION OCTOBER, 1988

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-1
LOCATION OF SWMUs OF INTEREST
TOOELE ARMY DEPOT

TABLE D-1

Summary of Field Program, SWMUs 20 and 21
Additional Data Collection Activities (a)(b)

SWMU Group/Name	Environmental Samples				Field QC Samples			Analytical Parameters
	Soil Borings							
	No. of Borings	No. of Samples/ Boring	Sample Depth (ft bgs)	SWMU Soil Samples	Field Duplicates Soil	MS/MSDs	Equipment Rinse Blanks	
Group A								
AED Deactivation Furnace Site (SWMU 20)	11	3	0, 1, 2	32	2	2	2	Antimony and lead
Deactivation Furnace Building (SWMU 21)	17	3	0, 1, 2 (c)	50	3	3	2	TAL metals, explosives (c)
	surface samples		0 to 0.5	8	0	0	1	TAL metals

Other Field QC Samples	No. of Samples	Analytical Parameters
Distilled water/source water	2	TAL metals, explosives, and TCL VOCs
Trip blank	4	TCL VOCs
Waste Handling Samples		
Borehole cuttings		
SWMU 21	1	TCLP metals, TCLP VOCs, TCLP SVOCs, and explosives
SWMU 20	1	TCLP metals, TCLP VOCs, and TCLP SVOCs
Decontamination waste		
Water	1	TCLP metals, explosives, TCLP VOCs, TCLP SVOCs, TCLP pesticides/herbicides, reactivity, F-listed solvents (F001-F005), TOX, and TOC

(a) Additional data collection activities also included SWMUs 2 and 23, results for which are reported in separate documents. Sample analysis from SWMUs 2 and 23 included volatile organic compounds (VOCs).

(b) bgs = below ground surface.
QC = quality control.
MS/MSD = matrix spike/matrix spike duplicate.
TAL = Target Analyte List.
TCL = Target Compound List.
TCLP = Toxicity characteristic leaching procedure.
SVOC = semivolatile organic compound.
TOX = total halogens.
TOC = total organic carbon.

(c) Only three soil samples from one boring in the former drum staging area were collected at 0, 2, and 4 feet bgs and analyzed for explosives (and TAL metals).

Soil borings were drilled and sampled using a Mobile Drill B-61 truck-mounted auger rig. The desired sample depth was reached by advancing the hollow-stem auger (HSA), then collecting the sample using a 3-inch-outside-diameter, 24-inch-long, split-spoon sampler. The sampler was lowered to the top of the desired sample interval and then driven with a 140-pound hammer dropped 30 inches. Attachment A includes the soil boring logs with borehole information, soil description, boring depth, and sample depths. Because of the shallow depths of the soil sampling activities, blow counts were not necessary. Because of the shallow depths of most of the soil borings, the samplers were driven into the subsurface to the required sample depth or until refusal. If the sample depth could not be reached due to spoon refusal, the sample depth was achieved by advancing the HAS through the area of refusal and then another spoon was attempted. If this failed, a new offset boring was attempted within close proximity of the original location.

After the sampler was driven to the desired sample interval, it was pulled from the borehole and carefully opened on a clean surface. Surface and subsurface samples were screened with a photoionization detector (PID) to detect VOCs. Samples requiring VOC analysis were immediately removed from the split-spoon and sealed in the sample container with no headspace to minimize the loss of VOCs. (None of the soils at SWMUs 20 and 21 were analyzed for VOCs). The remaining soil was logged by the geologist and thoroughly mixed in a clean stainless-steel bowl before filling each sample container for other chemical analyses.

D.2.2 SAMPLE IDENTIFICATION

The sample identification scheme presented in the Planning Documents (Dames & Moore, 1999) was developed to conform to the Installation Restoration Data Management Information System (IRDMIS) format. Each sample was assigned a Site Identification Number (Site ID) and a Field Sample Number (Sample ID).

The Site ID labels the geographic location where the sample was collected; therefore, all soil samples from the same borehole are assigned the same Site ID. The alphanumeric characters of the Site ID first identify the type of sample, then the site name, and finally the sample location number. For example, Site ID SB2021 indicates that the sample was a soil boring (SB), the sample was collected from SWMU 20, and the sample location was number 21.

The Sample ID is simply the Site ID with a letter character at the end to designate sample depth (i.e., A = 0 to 0.5 feet bgs). QC samples have an additional letter character at the end. Table D-2 lists the sample IDs. Attachment B presents the Chains of Custody for the additional sampling activities. Samples from SWMUs 2 and 23 are also presented on the Chains of Custody, but the sample results from these SWMUs are presented in separate documents.

TABLE D-2

Summary of Sample Identification, SWMUs 20 and 21
Additional Data Collection Activities

Area	No. of Sampling Locations	No. of Soil Samples	Sample ID No. (a)(b)		Sample Depth Code (ft bgs)
AED Deactivation Furnace Site (SWMU 20)	11 soil borings	32	SB2021A, B, C SB2022A, B, C SB2023A, B, C SB2024A, B, C SB2025A, B, C	SB2026A, B, C SB2027A, B, C SB2028A, B SB2029A, B, C SB2030A, B, C SB2031A, B, C	A = 0 to 0.5 B = 1 to 2 C = 2 to 3
Deactivation Furnace Building (SWMU 21)	17 soil borings	50	SB2101A, B, C SB2102A, B, C SB2103A, B, C SB2104A, B, C SB2105A, B, C SB2106A, B, C SB2107A, B, C SB2108A, B, C	SB2109A, B, C SB2110A, B, C SB2111A, B, C SB2112A, B, C SB2113A, B, C SB2114A, B SB2115A, B, C SB2116A, B, C SB2117A, C, D	A = 0 to 0.5 B = 1 to 2 C = 2 to 3 D = 4 to 5
	8 surface samples	8	SS2115 SS2116 SS2117 SS2118	SS2119 SS2120 SS2121 SS2122	All = 0 to 0.5

(a) Prefixes for sample ID numbers are as follows:
SB = soil boring
SS = surface soil sample.

(b) Field QC samples (presented in Attachment C) have the same sample ID numbers as associated field samples, plus the following suffixes:
"R" corresponds to a duplicate.
"B" corresponds to an equipment rinse blank.
"DW" corresponds to distilled water field blank.
"SW" corresponds to source water field blank.

D.2.3 SAMPLE HANDLING, STORAGE, AND SHIPPING

All sample containers were precleaned prior to shipment from the laboratory. Liquid VOC bottles were completely filled, leaving no headspace. All other liquid samples were filled with minimal headspace, except that bottles for liquid inorganic analysis were approximately 90 percent full. Samples were preserved with acid immediately following collection when required. Soil sample bottles were filled with minimal headspace. All samples were packed on ice immediately after collection. Samples were delivered by courier under chain-of-custody to the laboratory on the day of collection.

D.2.4 LAND AND UTILITY SURVEYS

Prior to sampling at SWMUs 20 and 21, sample locations were cleared for underground utilities by TEAD personnel, and excavation permits were obtained. Soil sample locations were measured to the nearest permanent markers or structures and noted in the fieldbook.

D.2.5 DECONTAMINATION PROCEDURES

TEAD water supply well WW-3, which had previously been used as a water source for field activities, provided water for field cleaning. The well was sampled and analyzed for chemicals of concern prior to the start of the field activities reported herein. Analytical results for the decontamination source water detected only low levels of several metals commonly found in local groundwater; no COCs were detected. The results are included in Attachment C, which presents chemical data results. All drilling equipment (i.e., HSA, drill rods and bits, and temporary casing, etc.) was steam cleaned upon arrival at the site, between borings, and before demobilization. All sampling equipment was scrubbed with approved water and then rinsed with distilled water. Sampling equipment was placed on plastic sheeting on the ground.

D.2.6 WASTE HANDLING

All wastes were handled in accordance with approved protocols. Used uncontaminated personal protective equipment (PPE) was disposed of in an approved facility garbage bin.

Decontamination water, plastic from the decontamination pools, and soil cuttings from the boreholes were containerized in U.S. Department of Transportation (DOT)-approved 55-gallon drums. The drums were then transported and unloaded at the 90-day storage yard. Soil cuttings were drummed in response to a Utah Department of Environmental Quality (UDEQ) request. One composite sample was taken from the decontamination water drums and analyzed for the list of analytes presented in Table D-1. Samples were collected separately for the soil cuttings from SWMUs 20 and 21 and analyzed for the list of analytes. Five drums of soil cuttings, four drums of water, and four drums of plastic accounted for the total waste generated at all four SWMUs included in the sampling activities. Because the analytical results detected low levels of F-listed solvents in the decontamination rinse water (toluene and 4-methylphenol at 4.6 micrograms per liter (µg/L) and 0.39 µg/L, respectively) and in the soil cuttings from SWMU 2, TEAD sent all 13 drums to Grassy Mountain Landfill in Utah for incineration and disposal.

D.2.7 ANALYTICAL METHODS

As discussed in the *Additional Data Collection Activities* report (Dames & Moore, 1999), U.S. Environmental Protection Agency (EPA) methods replaced U.S. Army Environmental Center (USAEC) methods for all analyses performed for this field investigation, as explained below:

- EPA methods have written validation protocols; because USAEC methods do not, data validation is more difficult and time consuming. Validation also is complicated by the need to perform an EPA-acceptable validation and a USAEC-acceptable validation, each of which requires review of control charts.

- Because EPA methods for organics can be reported down to the method detection limit (MDL) and for inorganics down to the instrument detection limit (IDL), they offer an effective increase in sensitivity.

- The use of EPA methods reduces the confusion and potential error associated with two sets of QC requirements. EPA historically has insisted on MS/MSDs as part of the analytical program; thus, the use of EPA methods provides necessary QC information by including MS/MSD samples in the relevant USAEC lots. USAEC methods do not require MS/MSDs, making them unavailable for validation.

Analytical methods were taken from SW-846, *Test Methods for Evaluating Solid Wastes*, 3rd Edition including Update III, July 1988. Comparability is not affected by this change because the instrumental methods of analysis are the same on an analyte-specific basis. For instance, where gas chromatography/mass spectrometry (GC/MS) methods have been used in the past, the EPA equivalent method for GC/MS analysis is used.

Differences do exist, however, in the manner in which USAEC and EPA define detection limits. Thus, detection and reporting limits may differ. The differences in the development of detection limits generally result in EPA methods having lower MDLs, while reporting limits tend to be comparable. To the extent that either method provides for a reporting limit that meets data quality objectives (DQOs) for the work, there is no loss in comparability.

D.2.8 CHEMICAL ANALYSIS RESULTS TABLES

Attachment C presents the complete analytical results from the sampling at each SWMU. Laboratory data are sent to IRDMIS, where the measured values are corrected for percent recovery, moisture, and dilution factor. The resulting (corrected) values are loaded into the IRDMIS database and are available for contractor use. These data are presented in the chemical analysis tables in Attachment C. Data results for equipment rinse blanks, field blanks, and trip blanks are presented after the SWMUs 20 and 21 soil data results.

Within the tables, if an analyte was detected in a particular sample, the Measurement Boolean (MB) column is blank; if an analyte was not detected in a particular sample, the MB is marked “LT” (less than the CRL or MDL for EPA methods). Laboratory flags (LF), assigned by the laboratory to qualify the data, are found in the L column. Data loaded into the IRDMIS database are electronically compared to an established set of analytical conditions criteria; data qualifier (DQ) codes are assigned by the USAEC chemist to indicate data acceptance or rejection based on abnormal analytical conditions or results.

Dames & Moore performed a 10 percent validation of the data, the results of which are shown in the validation flag (V) column; an explanatory reason code for specific validation flags is found in the R column. All data were found to be usable. The QC sample results indicated generally acceptable performance. Attachment D presents the overall data quality assessment. The validation results for the complete additional data activities are included. No reported values were qualified by USAEC. All reported values qualified by Dames & Moore are flagged in the chemical analysis tables.

D.2.9 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Numerous field and laboratory QC samples were analyzed and evaluated. Table D-1 shows the types and number of samples collected. Duplicate samples were collected at one per 20 samples. Samples SB2025B, SB2027B, SB2101A, SB2102B, and SB2108A had duplicate samples. Results are included in Attachment C. The analytical results of the QC samples were used to assess the usability of the chemical data and to identify procedural problems. Analytical results for the field blanks and equipment rinse blanks detected low levels of several metals commonly found in local groundwater. Low levels of the acetone were found in the field blanks. Low levels of acetone, carbon disulfide, and toluene were found in the equipment blanks. Low levels of acetone and methylene chloride were found in the trip blanks. Acetone and methylene chloride are considered common laboratory contaminants by EPA (USEPA, 1999). Results are included Attachment C. Attachment D discusses the quality assurance (QA)/QC assessment.

D.2.10 NATURE AND EXTENT OF CONTAMINATION

To evaluate potential impacts to human health, the analytes detected above background levels for which health effects criteria exist were identified as COPCs. The maximum concentration detected for each COPC was compared to the CAO developed in the CMS Work Plan (Dames & Moore, 2000) to evaluate which COPCs would be retained as COCs (i.e., those contaminants for which corrective measures are evaluated).

Appendix A of the CMS Work Plan (Dames & Moore, 2000) presents a detailed account of the development of CAOs. They were developed in accordance with the State of Utah Administrative Code (UAC) R315-101 (including the "Principle of Non-Degradation"), EPA guidance (USEPA, 1991a), and the human health risk assessment (RA) performed for the Group A SWMUs (Montgomery Watson, 1997).

D.3 AED DEACTIVATION FURNACE SITE (SWMU 20)

D.3.1 SWMU DESCRIPTION AND DATA GAPS

Figure D-2 shows the location and layout of the AED Deactivation Furnace Site (SWMU 20), which includes Buildings 1351, 1352, 1355, and 1356, and former Building 1354. However, only Buildings 1351 and 1352 are related to site activities. SWMU 20 is an approximately 180- by 225-foot asphalt pad located along the road between the AED Demilitarization Facility (SWMU 19; Group B SWMUs) and the Bomb Shell Reconditioning Building (SWMU 23; OU 9). The pad is underlain by compacted gravel fill. A small area near the western corner of the asphalt pad, which was reportedly once used to store drummed residue, is referred to as the former hazardous waste holding area.

Building 1351 has been active since approximately 1970; it includes a deactivation furnace (rotary-kiln type), a flashing furnace (installed in 1976), and an air pollution control system (installed in 1976). Building 1352 is a small storage building.

An underground storage tank (UST) containing No. 2 heating oil, with associated piping, is located in the central part of the facility, southeast of the main furnace. During summer and fall 1993, an aboveground diesel tank was installed approximately 100 feet northwest of Building 1351. Aboveground propane tanks are also located west of Building 1351.

SWMU 20 is currently used to conduct treatability studies and operates under interim RCRA approval through an experimental variance.

D.3.1.1 Previous Sampling Results

During the Phase I RFI (Montgomery Watson, 1993), 11 surface soil samples were collected from around the perimeter of the facility, and five samples were collected from beneath the asphalt pad. During the Phase II RFI (Montgomery Watson, 1997), three soil samples were collected from each of 19 soil borings drilled to a depth of 3 feet bgs. Each sample was analyzed for metals and explosives to investigate the vertical and horizontal extent of contamination detected during the Phase I RFI. Nine of these borings were drilled around the periphery of the asphalt pad, and 10 were drilled at distances up to 250 feet from SWMU 20 to investigate the possible extent of horizontal migration. Additional investigations performed during the Phase II RFI included the collection of six surface soil samples for chromium speciation and three surface soil samples for dioxin/furan analysis. Appendix B of the CMS Work Plan (Dames & Moore, 2000) presents chemical analysis results for SWMU 20 from the Phase I and II RFIs, as they were presented in the Phase II RFI Report.

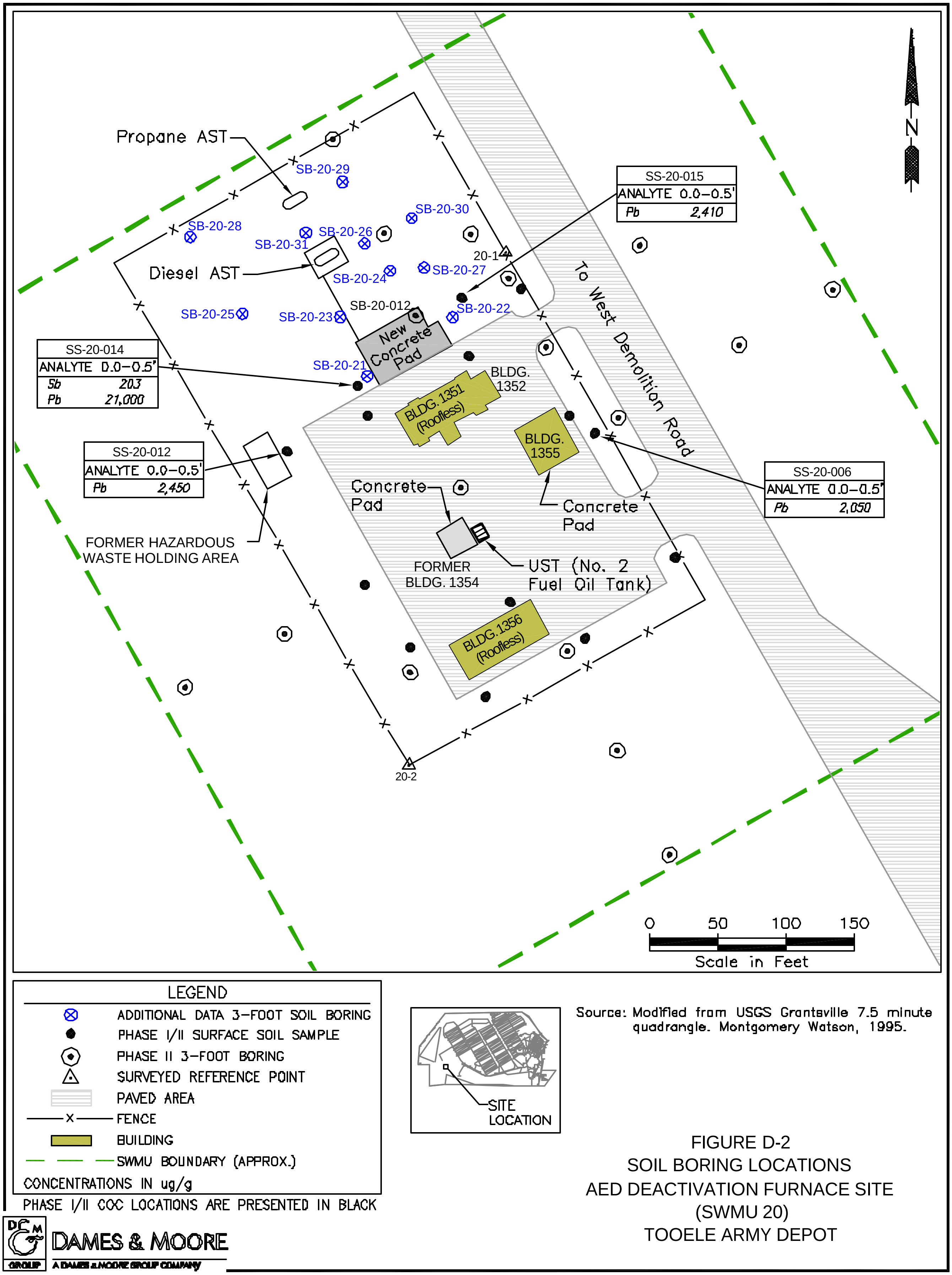
The Phase II RFI Report (Montgomery Watson, 1997) concluded that activities at SWMU 20 have released various contaminants, with the most likely sources being the deposition of stack emissions and surface spills of incinerator residues around the buildings and the former hazardous waste holding area.

Based on surface soil and shallow borehole sampling, the highest levels of metals appear to occur at the edge of the asphalt pad; metals detections decrease with distance from the pad. The Phase II RFI (Montgomery Watson, 1997) identified 10 metals – antimony, barium, cadmium, chromium (total), chromium (VI), copper, lead, mercury, thallium, and zinc – as COPCs in surface soil. The CMS Work Plan (Dames & Moore, 2000) identified antimony and lead as COCs in surface soil at SWMU 20. Concentrations of lead exceeded its CAO at four locations, with a maximum concentration of 21,000 micrograms per gram (µg/g; see Figure D-2). Antimony exceeded its CAO once at a concentration of 203 µg/g (see Figure D-2). Section D.3.4 compares the additional data results to the extent of COCs determined in the CMS Work Plan.

In the RFI, metals were detected at elevated levels in shallow subsurface soil in 12 borings at depths between 1 and 3 feet bgs. In general, metals concentrations decreased with depth. The three boreholes that contained the most elevated metals concentrations were drilled in areas that tend to collect stormwater runoff from the asphalt pad. Seven metals – cadmium, chromium (total), copper, lead, mercury, thallium, and zinc – were identified as COPCs in subsurface soil; however, no subsurface COCs were identified in the CMS Work Plan.

D.3.1.2 Data Gaps

Earthmoving activities – which changed the COC distribution – were conducted at SWMU 20 after collection of the Phase II data. Contaminated soil was potentially



Source: Modified from USGS Grantsville 7.5 minute quadrangle. Montgomery Watson, 1995.

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FIGURE D-2
SOIL BORING LOCATIONS
AED DEACTIVATION FURNACE SITE
(SWMU 20)
TOOELE ARMY DEPOT

regraded during construction activities, which included installation of the concrete pad immediately northwest of Building 1351. It is uncertain whether the excavated soil was spread evenly around the area northeast of Building 1351 or was spread over a few smaller areas. Therefore, additional soil samples were needed to define the actual extent of the COCs antimony and lead.

D.3.2 FIELD INVESTIGATION

The additional data soil sampling activities occurred during December 1999. The soil sampling at SWMU 20 is summarized below:

- Eleven borings (SB2021 through SB2031) were advanced to a depth of 3 feet to evaluate the extent of antimony and lead contamination. The area of investigation focused on the field north of the regraded area, where the soil was most likely relocated. Soil boring locations were agreed upon by UDEQ personnel and TEAD during a site walk of SWMU 20 prior to field activities. The soil boring locations are presented on Figure D-2, and Attachment A presents detailed boring logs.

- Three soil samples were collected from each boring from 0 to 0.5, 1 to 2, and 2 to 3 feet bgs. No sample was collected at SB2028 from 2 to 3 feet bgs because there was no recovery in the split-spoon other than quartzite cobbles between 2 to 4 feet bgs. A total of 34 samples were collected, including two duplicates.

- Soil samples were analyzed for antimony and lead.

D.3.3 RESULTS

Antimony was detected in 13 of the 34 additional data soil samples; lead was detected in all 34 soil samples. Attachment C presents the complete analytical data results, and Attachment D presents the data validation reports. The results are evaluated in two steps: the sample data are compared to background to determine whether addition COPCs are present; and the new COPC concentrations are screened against CAOs to determine whether additional COC locations need attention.

Surface soil samples are those from 0 to 0.5 ft bgs and 1 to 2 ft bgs; the same designation as in the RFI. Antimony was detected above the basewide background level of 1.45 µg/g in eight surface soil samples at six borehole locations. Lead was detected above the basewide background level of 96.7 µg/g in three surface soil samples at three borehole locations. Only antimony was detected above background in subsurface soil and only in one sample.

The maximum detections from the additional data occurred in sample SB2022 (1 to 2 feet bgs), at concentrations of 7.92 µg/g and 244 µg/g for antimony and lead, respectively.

The surface and subsurface COPC locations (i.e., detections above background) for antimony and lead are shown on Figure D-3. Presented below are the maximum antimony and lead concentrations, with associated background comparison criteria:

SWMU 20 COPCs		
COPC (a)	**Maximum (µg/g)**	**Background (b) (µg/g)**
Surface Soil		
Antimony	7.92	1.45
Lead	244	96.7
Subsurface Soil		
Antimony	1.47	1.45

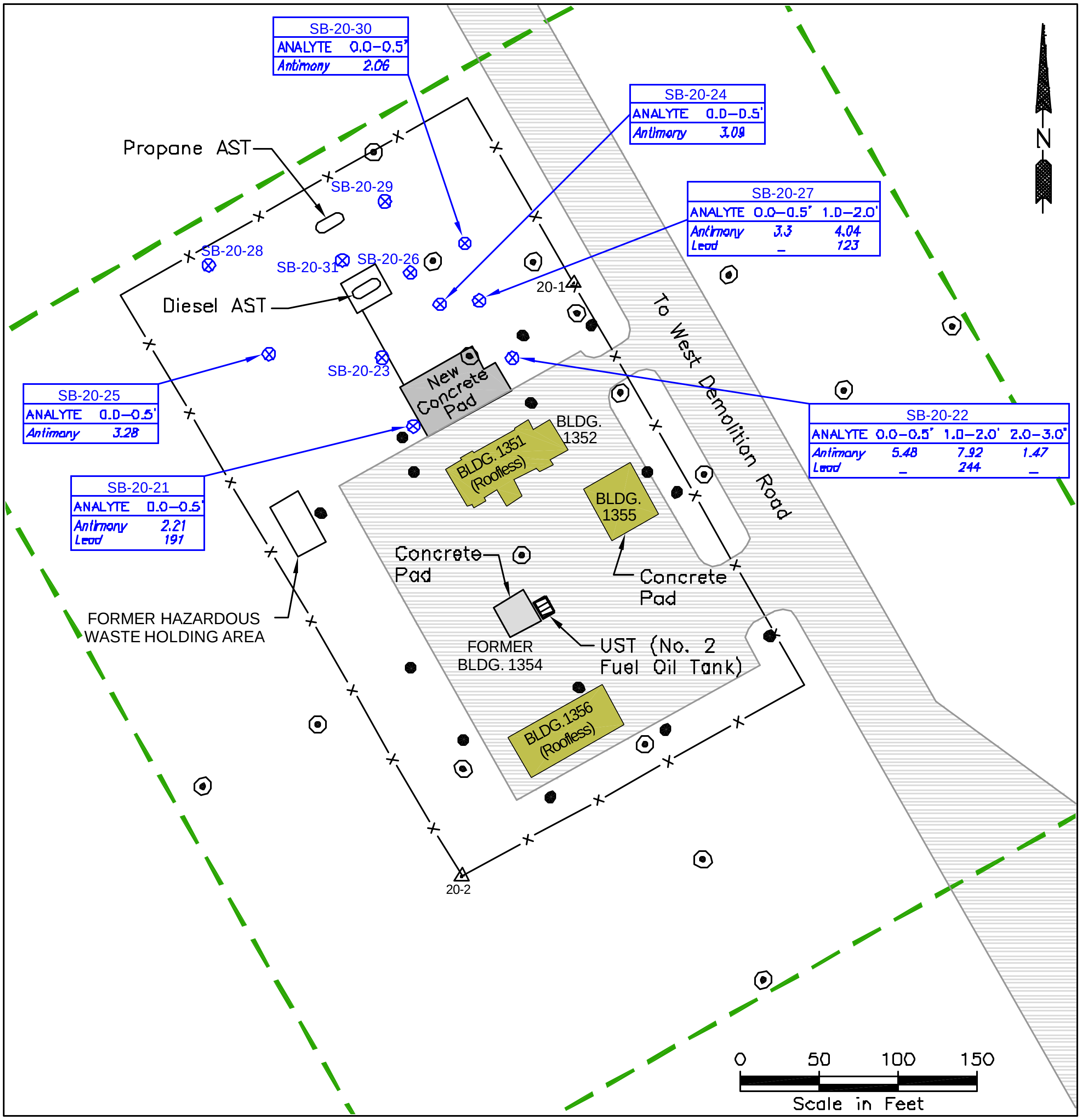
(a) Contaminants of potential concern identified from additional data sampling.
(b) Background concentrations presented in the CMS Work Plan (Dames & Moore, 2000).

Because the current and anticipated future land use for SWMU 20 is military, maximum surface soil COPC detections were compared to CAOs for Depot personnel, and maximum subsurface soil COPC detections were compared to CAOs for a construction worker. As presented below, both COPCs were below CAOs in surface and subsurface soil:

Development of SWMU 20 COCs			
COPC (a)	**Maximum (µg/g)**	**Depot Worker CAO (b) (µg/g)**	**COC?(c)**
Surface Soil			
Antimony	7.92	160	No
Lead	244	1,800	No
Subsurface Soil		**Industrial Worker CAO (b)**	
Antimony	1.47	140	No

(a) Contaminants of potential concern identified from additional data sampling.
(b) CAOs developed in CMS Work Plan (Dames & Moore, 2000).
(c) Contaminants of concern (i.e., COPCs greater than CAOs).

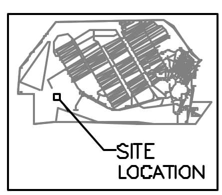
The additional sampling identified no new COC locations. The results show that elevated antimony and lead occur in the top foot of soil, with isolated areas of elevated metals at 1



LEGEND

- ADDITIONAL DATA 3–FOOT SOIL BORING
- PHASE I/II SURFACE SOIL SAMPLE
- PHASE II 3–FOOT BORING
- SURVEYED REFERENCE POINT
- PAVED AREA
- FENCE
- BUILDING
- SWMU BOUNDARY (APPROX.)

CONCENTRATIONS IN ug/g



Source: Modified from USGS Grantsville 7.5 minute quadrangle. Montgomery Watson, 1995.

FIGURE D-3
ANTIMONY AND LEAD IN SOIL DETECTED ABOVE BACKGROUND
AED DEACTIVATION FURNACE SITE (SWMU 20)
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to 2 ft bgs. Soil from 2 to 3 ft bgs has almost no detections above background and limits the elevated metals to the surface soil only.

D.3.4 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of soil contamination is based on both the Phase II RFI results (Montgomery Watson, 1997) and the additional data collection activities discussed above.

As shown on Figure D-4, the maximum Phase II RFI lead detection at SWMU 20 occurred in surface soil sample SS-20-014 which detected lead at 21,000 µg/g and antimony slightly above its CAO. Lead was also detected above military use CAOs (1,800 µg/g) at SS-20-015, SS-20-006, and SS-20-012. Soil boring SB-20-012, which had lead detections far below it's CAO, was collected within an area where earthmoving activities later occurred for a concrete pad. Soil near COC location SS-20-014 may have been excavated as well. The additional sampling after the earthmoving activities found soil near Phase II COC locations SS-20-014 and SS-20-015 to contain lead above background levels but below residential and military use CAOs. Additional data samples SB2024, SB2027, and SB2030 collected north to northeast of the new concrete pad detected antimony and lead at concentrations far below CAO levels, but above concentrations detected in that area during the Phase II RFI. Based on the extensive RFI and additional sampling data (105 samples for lead and antimony), it appears that the 21,000 µg/g detection of lead was confined to a very small portion of SWMU 20. Soil with low lead contamination appears to have been moved to north of the concrete pad.

Phase II RFI samples SS20012 and SS20006 also contained lead above its CAO; however, no additional samples were collected from the vicinity of these samples because no soil regrading occurred near these samples. These COC locations are unaffected by site regrading.

D.3.5 ESTIMATE OF CONTAMINATED VOLUME

Figure D-4 shows the four Phase II RFI lead and antimony COC locations. The additional sampling identified no new COC locations; and antimony and lead were detected at levels above background but below CAOs near Phase II RFI COC locations SS-20-014 and SS-20-015. Based on the COC locations, the estimated area of SWMU 20 with elevated concentrations of antimony and lead is 7,200 square feet (ft^2). As shown on Figure D-4, the contaminated area is located around the northwest side of the paved area and northeast of Building 1355, between the paved area and the road. For the purpose of the CMS, it is assumed that the identified area contains contaminated soil to a depth of 1 foot bgs; deeper soils contained no COCs. As a result, the estimated volume of metals-contaminated soil is 270 cubic yards (yd^3). The additional sampling suggests that the volume of soil containing lead above 1,800 µg/g may be smaller than 270 yd^3. However, it is recommended that the area shown on Figure D-4 is addressed unless confirmation sampling is conducted and determines a smaller or otherwise different extent of contamination.

D.3.6 CONCLUSIONS

The additional data soil sample results identified no new COC locations for antimony and lead. These metals were detected above background levels near the previously known COC locations, as well as to the north of the concrete pad. It appears that soil with lead above background levels was moved during regarding. However, because the areas around the RFI COCs still have elevated antimony and lead, they are retained as part of the estimated area of contamination.

D.4 DEACTIVATION FURNACE BUILDING (SWMU 21)

D.4.1 SWMU DESCRIPTION AND DATA GAPS

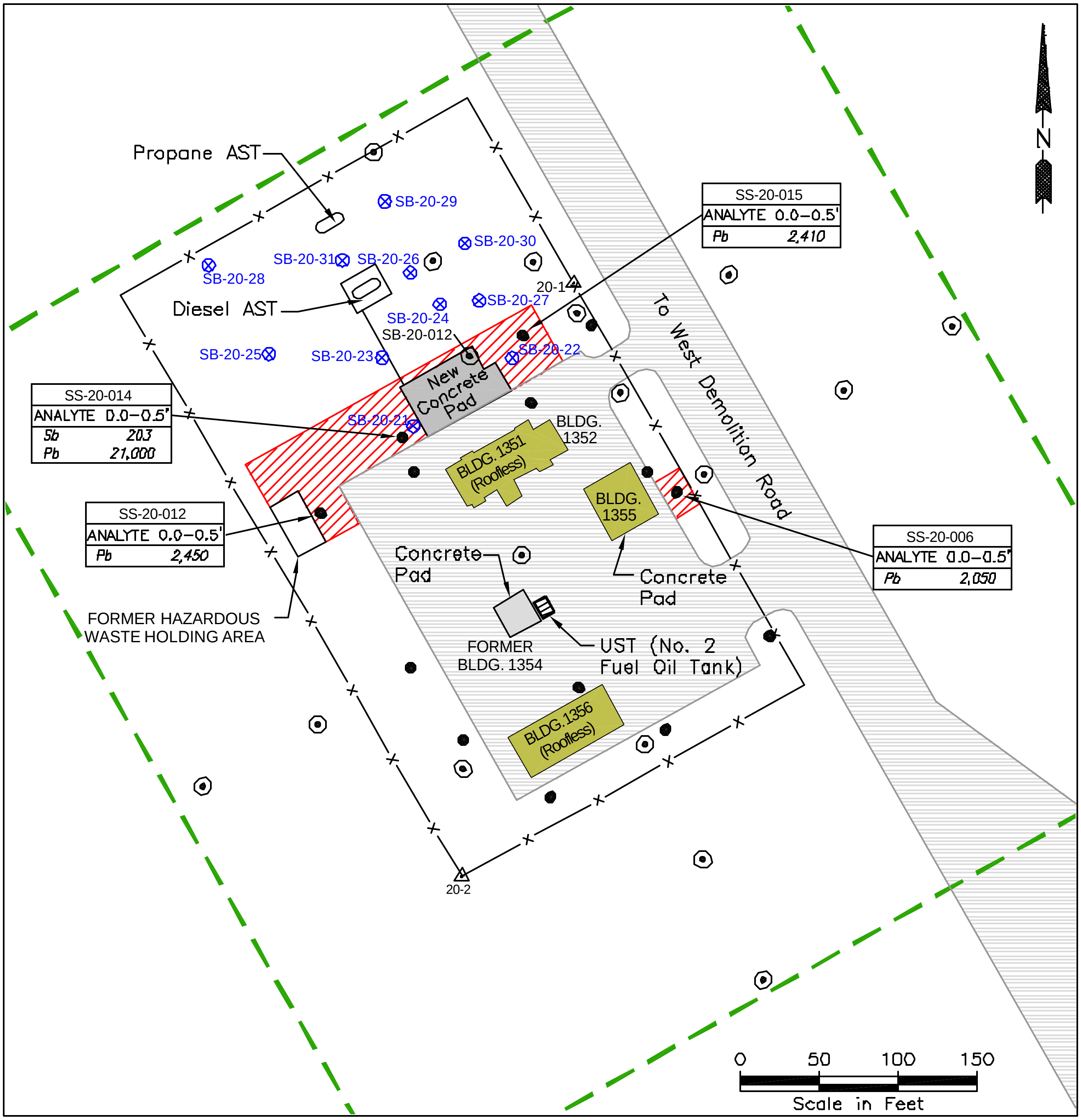
Figure D-5 shows the location and layout of the Deactivation Furnace Building (SWMU 21), which occupies 0.7 acre in the southwestern portion of TEAD. SWMU 21 is an ammunition demilitarization production facility (Building 1320) that was constructed about 1955 (NUS, 1987) and currently operates under a RCRA Part B permit.

The areas exclusive of the deactivation furnace that are being proposed for corrective measures were contaminated prior to the facility becoming a permitted unit. Current operations do not add to the previous contamination. Building 1320 contains a rotary kiln. Open staging areas for support equipment and drums are located around the outside of the building. These areas are mostly paved with asphalt and concrete, and partly covered with gravelly soil. The kiln was originally fired by fuel oil from an UST located immediately west of the building; more recently, an aboveground tank was installed to the east. The newer tank sits on a sealed, bermed concrete pad designed to contain releases. A propane tank is also located east of Building 1320.

The furnace in Building 1320 is used to deactivate small arms ammunition, primers, and fuses (Rhea, 1990). Air pollution control equipment was installed around 1975. Incinerator residue (ash and metal debris) is collected at the south end of the furnace and loaded into 55-gallon drums for temporary storage.

D.4.1.1 Previous Sampling Results

Ten surface soil samples were collected from the perimeter of the facility and beneath the staging areas during the Phase I RFI (Montgomery Watson, 1993). The majority of these samples were collected along the edges of asphalt or concrete areas that receive stormwater runoff. All soil samples were analyzed for metals, cyanide, VOCs, SVOCs, dioxins/furans, explosives, and selected anions. Four additional surface soil

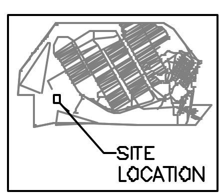


LEGEND

- ADDITIONAL DATA 3–FOOT SOIL BORING
- PHASE I/II SURFACE SOIL SAMPLE
- PHASE II 3–FOOT BORING
- SURVEYED REFERENCE POINT
- PAVED AREA
- FENCE
- BUILDING
- APPROXIMATE AREA OF CONTAMINATION
- SWMU BOUNDARY (APPROX.)

CONCENTRATIONS IN ug/g

PHASE I/II COC LOCATIONS ARE PRESENTED IN BLACK



Source: Modified from USGS Grantsville 7.5 minute quadrangle. Montgomery Watson, 1995.

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FIGURE D-4
COC LOCATIONS AND APPROXIMATE AREA OF CONTAMINATION
AED DEACTIVATION FURNACE SITE (SWMU 20)
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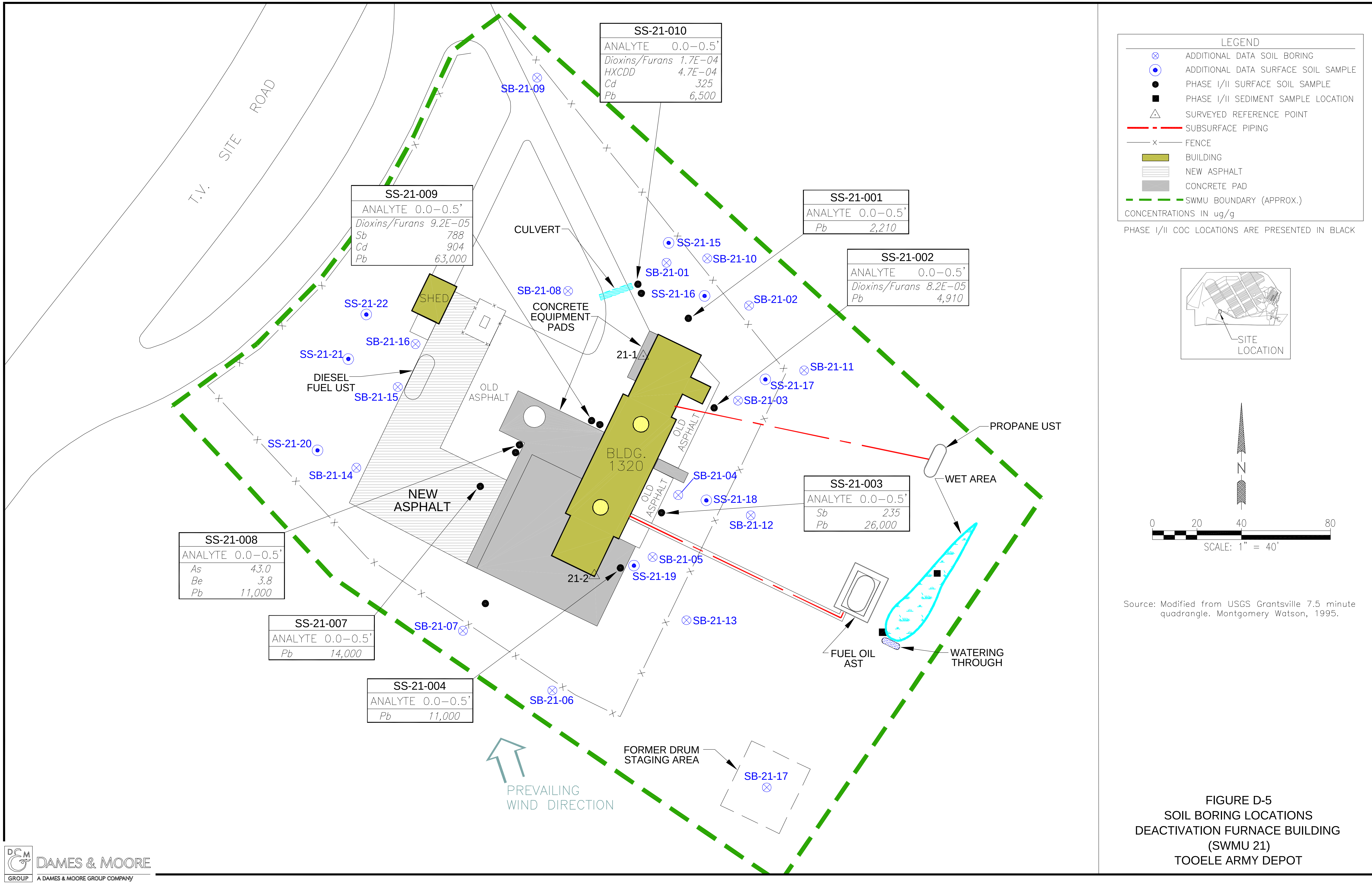

FIGURE D-5
SOIL BORING LOCATIONS
DEACTIVATION FURNACE BUILDING
(SWMU 21)
TOOELE ARMY DEPOT

samples were collected and submitted for total chromium and hexavalent chromium analysis only. No extensive sampling was conducted during the Phase II RFI because the deactivation furnace is a RCRA Part B permitted facility, and it was assumed that the entire site would require environmental sampling at closure (Montgomery Watson, 1997). However, in 1997, a determination was made that contamination at the site predated the RCRA permit, thus allowing the cleanup to move forward under the Corrective Action Permit. Appendix B of the CMS Work Plan (Dames & Moore, 2000) presents Phase I chemical analysis results for SWMU 21 as they were presented in the Phase II RFI Report.

Twelve metals – antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, manganese, mercury, thallium, and zinc – were detected at elevated levels in the Phase I RFI (Montgomery Watson, 1993) and were identified as COPCs in the Phase II RFI (Montgomery Watson, 1997). Elevated levels of the metals were detected in all of the 10 surface soil samples collected at the site.

The Phase II RFI (Montgomery Watson, 1997) retained dioxins/furans as a COPC in surface soil; HxCDDs were not identified as a COPC, but are retained as a COPC in the CMS Work Plan (Dames & Moore, 2000) based on additional toxicity data not included in the RFI.

One explosive compound – 2,4,6-trinitrotoluene (TNT) – was retained as a surface soil COPC in the Phase II RFI (Montgomery Watson, 1997), but was not identified as a COC. As discussed in Section 6.4 of the CMS Work Plan (Dames & Moore, 2000), this COPC was also detected at a much higher concentration (16,000 µg/g) in stained soil at the former drum staging area. However, the stained soil was removed from the site, indicating that the elevated concentrations of 2,4,6-TNT (and other contaminants) are no longer present in this area.

The CMS Work Plan (Dames & Moore, 2000) identified antimony, arsenic, beryllium, cadmium, lead, dioxins/furans, and HxCDDs as COCs at SWMU 21. Figure D-5 shows the COC locations. In surface soil, lead exceeds its CAO at eight locations. The COC exceedances for each of the other contaminants occur at one or more of the same locations. Dioxin/furan exceedances occur at three locations; antimony and cadmium at two locations; and arsenic, beryllium, and HxCDDs at one location. The 2,4,6-TNT location was removed, and consequently is not marked as a COC. Section D.4.4 compares the additional data results to the extent of COCs identified in the CMS Work Plan.

The Phase II RFI Report (Montgomery Watson, 1997) concluded that the deposition of stack emissions and surface spills of incinerator ash around Building 1320 and at the former drum storage area released the detected COPCs to surface soil. The concentrations of COPCs detected at the site were determined to be related to stormwater runoff from asphalt or concrete surfaces near the furnace building. Contaminant levels are expected to decrease with distance from the building.

D.4.1.2 Data Gaps

Contaminants were found in nearly every sample during the Phase II RFI; no clean areas were encountered. Subsequent to the RFI sample events, additional pavement was installed around Building 1320. This pavement covers a significant area of contaminated soil, thus eliminating the potential for direct contact. However, because the vertical and horizontal extent of contamination at SWMU 21 was not adequately defined, additional surface and subsurface soil samples were needed to evaluate and select a corrective measures alternative for the entire extent of contamination. Samples were also needed at the former drum staging area to confirm that the removal of stained soil was adequate in mitigating local contamination.

D.4.2 FIELD INVESTIGATION

The additional data soil sampling activities occurred during December 1999. The soil sampling at SWMU 21 is summarized below:

- Sixteen borings (SB2101 through SB2116) were advanced to a depth of 3 feet to evaluate the extent of metals contamination. Sample locations were biased along the prevailing northwest-southeast wind direction to limit the extent of stack emission deposition. One additional boring was advanced to 5 feet to evaluate soil in the former drum staging area. Eight surface soil samples (SS2115 through SS2112) were also collected. The boring and surface soil sample locations are illustrated on Figure D-5. Attachment A presents the detailed boring logs.

- Three soil samples were collected from each of the 3-foot borings from 0 to 0.5, 1 to 2, and 2 to 3 feet bgs. No sample was collected from SB2114 from 2 to 3 feet bgs because of auger/spoon refusal (two additional off-set attempts were also unsuccessful). The three soil samples in the former drum staging area were collected from 0 to 0.5, 2 to 3, and 4 to 5 feet bgs. In addition, eight surface soil samples were collected from 0 to 0.5 foot. A total of 61 samples were collected, including three duplicates.

- Soil samples were analyzed for TAL metals. The three soil samples from the former drum staging area were analyzed for explosives and TAL metals.

D.4.3 RESULTS

From the 61 additional data soil samples collected, all 23 metal constituents analyzed at SWMU 21 were detected at least once. Attachment C presents the complete analytical data results, and Attachment D presents the data validation reports. The primary metals of concern – antimony, arsenic, cadmium, and lead – were detected in most or all of the samples. Samples at boring locations SB2117 were also analyzed for explosives, but none were detected.

Soil COPCs for SWMU 21 are those analytes that were detected at concentrations greater than established background concentrations (for those analytes that have comparison criteria) or were simply detected (for those analytes that have no comparison criteria). A total of 14 metals were detected above background levels in surface soil samples; a total of four metals were detected above background levels in subsurface soil samples (greater than 2 feet bgs). Table D-3 lists the additional data COPCs with their maximum concentrations and associated background comparison criteria.

Cobalt, iron, nickel, selenium, silver, and thallium are identified in Table D-3 as COPCs; these metals were not previously identified as surface soil COPCs in the Phase II RFI.

Because the current and anticipated future land use for SWMU 21 is military, the maximum surface soil COPC detections were compared to CAOs for Depot personnel, and the maximum subsurface COPC detections were compared to CAOs for a construction worker. As presented in Figure D-6 and Table D-4, lead, antimony, and arsenic are the surface soil COCs. No subsurface COCs were identified. No new metals are added to the COCs identified in the CMS Work Plan, however, the lateral and vertical extent of COCs has been delineated.

Lead was detected above surface soil CAOs at nine locations; antimony and arsenic were each detected above CAOs at one location. Figure D-6 shows the COC locations; the additional data COC locations are shown in blue, while the RFI data results are shown in black. Surface soil results from the Phase II RFI identified these three metals as COCs, along with cadmium and beryllium.

D.4.4 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of soil contamination is based on both the Phase II RFI results (Montgomery Watson, 1997) and the additional data collection activities discussed above. The maximum lead detection from the additional data is 10,800 µg/g, which is lower than the maximum lead concentration from the Phase II investigation (63,000 µg/g). Lead was present above its CAO at sample locations surrounding Building 1320, but the highest detected concentrations were generally found closest to the building. The extent of lead contamination above COCs is bounded by additional samples without COC levels of lead on all sides of Building 1320. However, there is an isolated lead COC of 3,820 µg/g in SB2109, in the northwest corner of SWMU 21. This boring appears to be isolated because of the distance between it and the high lead nearer Building 1320. As shown on Figure D-6, the extent of lead contamination appears to be elongated along the prevailing wind flow direction of southeast to northwest. There are no subsurface lead COCs and only two lead COC locations between 1 to 2 feet bgs. Therefore, the volume of lead contamination appears to be limited between 1 to 2 feet bgs.

TABLE D-3

Surface and Subsurface Soil COPCs
Deactivation Furnace Building (SWMU 21)

COPC (a)	Maximum Concentration (µg/g)	Background Concentration (b) (µg/g)
Surface Soil		
Antimony	225	1.45
Arsenic	39.5	32
Barium	3,640	291
Cadmium	105	1.33
Chromium	154	23
Cobalt	9.79	9.63
Copper	6,240	39.9
Iron	35,700	27,300
Lead	10,800	96.7
Mercury	0.446	0.11
Nickel	72.7	26.5
Selenium	0.551	0.198
Silver	16.1	7.75
Zinc	4,970	137
Subsurface Soil		
Antimony	5.18	1.45
Cadmium	1.8	1.33
Copper	110	39.9
Chromium	112	23

(a) Contaminants of potential concern identified from the additional data sampling.
(b) Background concentrations presented in the CMS Work Plan (Dames & Moore, 2000).

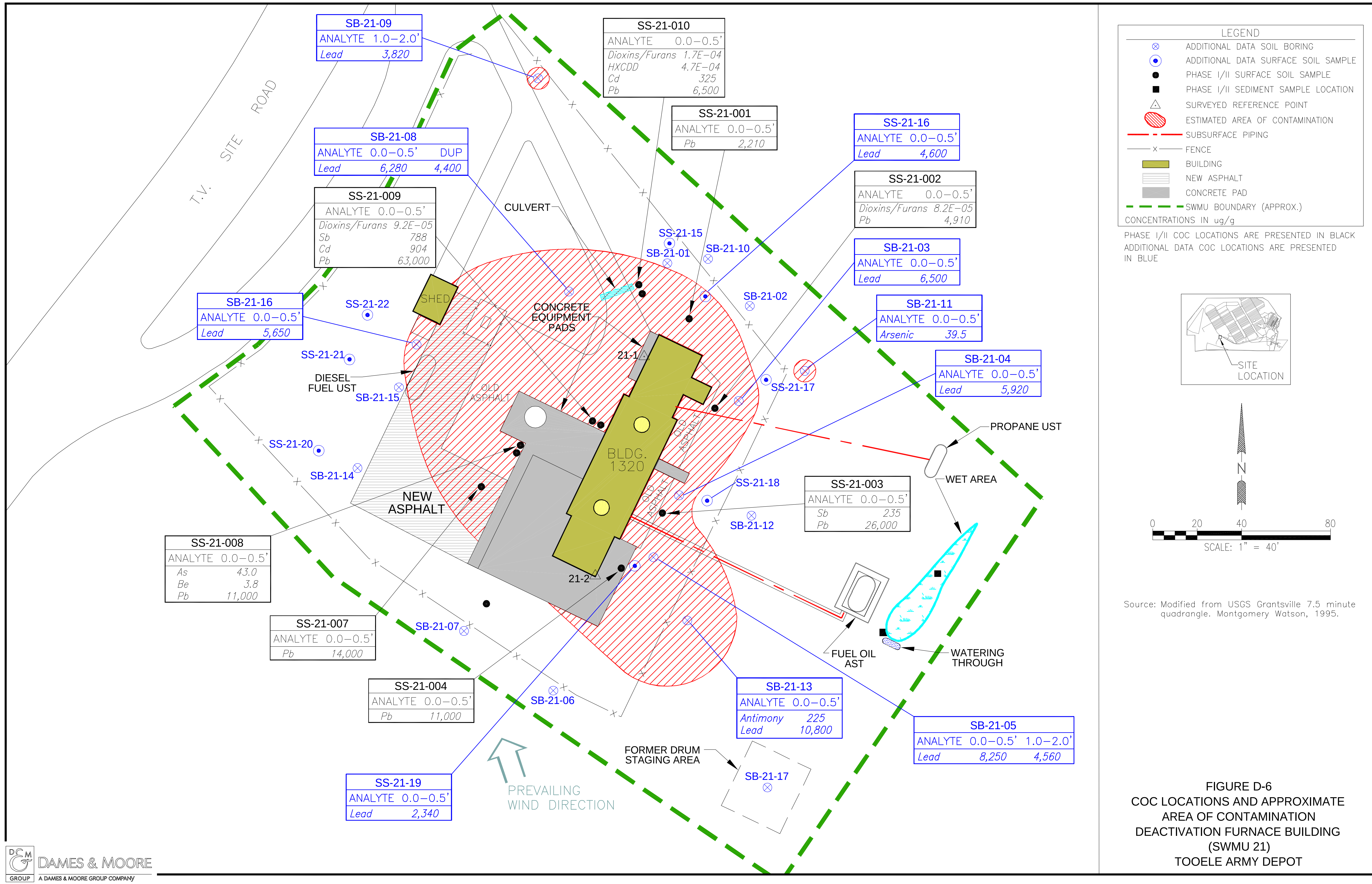

FIGURE D-6
COC LOCATIONS AND APPROXIMATE AREA OF CONTAMINATION
DEACTIVATION FURNACE BUILDING (SWMU 21)
TOOELE ARMY DEPOT

TABLE D-4

Development of COCs in Surface and Subsurface Soil
Deactivation Furnace Building (SWMU 21)

COPC (a)	Maximum Concentration (µg/g)	Depot Worker CAO (b) (µg/g)	COC? (c)
Surface Soil			
Antimony	225	160	**Yes**
Arsenic	39.5	32	**Yes**
Barium	3,640	71,000	No
Cadmium	105	220	No
Chromium	154	2,000	No
Cobalt	9.79	130,000	No
Copper	6,240	68,000	No
Iron	35,700	440,000	No
Lead	10,800	1,800	**Yes**
Mercury	0.446	440	No
Nickel	72.7	36,000	No
Selenium	0.551	10,000	No
Silver	16.1	7,900	No
Zinc	4,970	490,000	No
Subsurface Soil		**Industrial Worker CAO (b)**	
Antimony	5.18	470	No
Cadmium	1.8	870	No
Copper	110	64,000	No
Chromium	112	23,000	No

(a) Contaminants of potential concern identified from additional data sampling.
(b) CAOs developed in CMS Work Plan (Dames & Moore, 2000).
(c) Contaminants of concern (i.e., COPCs greater than CAOs).

There is only one new antimony COC location – SB2109 – at 1 to 2 feet bgs (see Figure D-6). This location is within the extent of lead contamination and is vertically bound by samples with antimony below its CAO. The single new arsenic COC is at SB2111 (0 to 1 ft bgs), at a concentration of 39.5 µg/g; however, this sample location is beyond the extent of lead contamination.

D.4.5 ESTIMATE OF CONTAMINATED VOLUME

Figure D-6 shows the COC locations at SWMU 21. The estimated area of SWMU 21 with lead contamination is 15,200 ft^2 (Figure D-6), which excludes Building 1320 and the concrete equipment pads. The equipment pads were poured in August 1999 and are 2 feet thick; contaminated surface soil was excavated and properly disposed during construction activities. The area of lead contamination surrounds Building 1320, along with an additional area of contamination at SB2109.

The COC locations for the other additional data and Phase II contaminants are located within the extent of contamination for lead. The only exception is a single arsenic CAO exceedance at SB2111. Therefore, an additional 100-ft^2 area of contamination is included beyond the extent of lead contamination.

For the purpose of the CMS, it is assumed that all the identified areas contain contaminated soil to a depth of 1.5 foot bgs. As a result, the estimated volume of contaminated soil is 850 ft^3.

D.4.6 CONCLUSIONS

Additional samples were collected at SWMU 21 to define the horizontal and vertical soil contamination detected during the Phase II RFI. The additional samples appear to limit the extent of lead contamination generally to within 100 feet of Building 1320. One small area of lead contamination exists in the northwest corner of the SWMU. The other COC locations lie within the lead contaminated area, except for an isolated arsenic COC in the north-central part of the SWMU. Unacceptable contaminant concentrations at the Deactivation Furnace Building appear to exist only within the top 1 to 2 feet of soil.

D.5 REFERENCES

Dames & Moore, 2000. *Corrective Measures Study Work Plan, Group A Suspected Releases SWMUs, Tooele Army Depot, Tooele, Utah*, Contract No. DACA31-94-D-0060, prepared for Tooele Army Depot, Tooele, Utah, May 1999.

Dames & Moore, 1999. *Additional Data Collection Activities, SWMUs 2, 20, 21, and 23, Tooele Army Depot, Tooele, Utah,* Contract No. DACA31-94-D-0060, prepared for Tooele Army Depot, Tooele, Utah, December 1999.

Montgomery Watson Consulting Engineers, 1997. *Tooele Army Depot – North Area, Group A Suspected Releases SWMUs – Final (2nd Revision) Phase II RFI Report*, prepared for U.S. Army Environmental Center, Aberdeen proving Ground, Maryland, August 1997.

Montgomery-Watson Consulting Engineers, 1993. *Final Phase I, RFI Report, Tooele Army Depot – North Area Suspected Releases SWMUs*, DAAA15-90-D-0011, prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland, December 1993.

NUS, 1987. *Draft Interim RCRA Facility Assessment*, Contract No. 68-01-7310, prepared for U.S. Environmental Protection Agency, July 1987.

Rhea, K., 1990. Personal communication, J. Mackinnon, Environmental Engineer, E.C. Jordan Co., with K. Rhea, TEAD-N employee, July 26, 1990.

Rust E&I, 1997b. *Tooele Army Depot, Final Site-Wide Ecological Risk Assessment*, prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland.

SEC Donohue, 1993. *Tooele Army Depot – North Area, Phase II RCRA Facility Investigation Known Releases SWMUs Final Data Collection Quality Assurance Plan*, prepared for U.S. Army Environmental Center, Aberdeen Proving Ground, Maryland.

U.S. Environmental Protection Agency (USEPA), 1999. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, PB99-963506, Office of Emergency and Remedial Response, Washington, D.C.

ATTACHMENT A

Soil Boring Logs

BORING SB2021

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-2
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Sample	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, very slight moist
	1	SS	B	1-2	<1				(1-2 feet) Brown silty fine SAND, some silt, much fine to coarse gravel, dry (quartzite cobbles)
	2	SS	C	2-3	<1				(2-3 feet) SAME AS ABOVE, much fine rounded quartz/quartzite, with rock flour
	3								BORING TERMINATED AT 3.0 FEET
	4								
	5								
	6								

Many large quartzite cobbles 0-3 feet
Deeper samples may contain some rock flour due to spoon/auger action.

Quartzite cobble layer from 2-3 feet bgs fairly uniform throughout site (SWMU 20).

BORING SB2022

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-2
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Sample	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, moist
	1	SS	B	1-2	<1				(1-2 feet) Brown silty fine SAND, some silt, much fine to coarse gravel, rock flour, dry
	2	SS	C	2-3	<1				(2-3 feet) SAME AS ABOVE BORING TERMINATED AT 3.0 FEET Some large quartzite cobbles 0-3 feet Deeper samples may contain some rock flour due to spoon/auger action.
	3								
	4								
	5								
	6								

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BORING SB2023

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-2
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, very slight moist
	1	SS	B	1-2	<1				(1-2 feet) Brown silty fine SAND, some silt, much fine to coarse gravel, rock flour, dry (quartzite cobbles)
	2	SS	C	2-3	<1				(2-3 feet) SAME AS ABOVE BORING TERMINATED AT 3.0 FEET Some large quartzite cobbles 0-3 feet Deeper samples may contain some rock flour due to spoon/auger action.
	3								
	4								
	5								
	6								

LOG OF BORING

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BORING SB2024

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah

Boring Location: See Figure D-2

Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, moist
	1	SS	B	1-2	<1			SM/SW	(1-2 feet) Brown silty fine SAND, some silt, much fine to coarse gravel, dry (quartzite cobbles)
	2	SS	C	2-3	<1			SM/SW	(2-3 feet) SAME AS ABOVE with much quartzite cobbles, rock flour
	3								BORING TERMINATED AT 3.0 FEET Some large quartzite cobbles 0-3 feet Deeper samples may contain some rock flour due to spoon/auger action.
	4								
	5								
	6								

BORING SB2025

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-2
Driller: Layne Christiansen

Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Symbols	Description
0	H	A	0-.5	<1		SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, very slight moist
1	SS	B	1-2	<1			(1-2 feet) Brown silty fine SAND, some silt, much fine to coarse gravel, trace rock flour, dry (quartzite cobbles)
2	SS	C	2-3	<1			(2-3 feet) SAME AS ABOVE

Not as much gravel in B and C samples as in other boring locations at SWMU 20.

BORING TERMINATED AT 3.0 FEET

Some large quartzite cobbles 0-3 feet
Deeper samples may contain some rock flour due to spoon/auger action.

BORING SB2027

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-2
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows	per	Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1					SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, very slight moist
	1	SS	B	1-2	<1						(1-2 feet) Brown silty fine SAND, some silt, much fine to coarse gravel, dry
	2	SS	C	2-3	<1						(2-3 feet) SAME AS ABOVE with some coarse sand, rock flour Auger refusal at 2 feet before taking C sample. Offset hole 4 feet to take C sample. BORING TERMINATED AT 3.0 FEET
	3										Some large quartzite cobbles 0-3 feet Deeper samples may contain some rock flour due to spoon/auger action.
	4										
	5										
	6										

BORING SB2028

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-2
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, very slight moist
	1	SS	B	1-2	<1			SM/SW	(1-2 feet) Brown silty fine SAND, some silt, much fine to coarse gravel, dry
	2	SS	NS	2-3				SM/SW	(2-3 feet) NO SAMPLE RECOVERY. No recovery in spoon besides gravel. Quartzite cobbles 2-4 feet.
	3								BORING TERMINATED AT 3.0 FEET
	4								
	5								
	6								

Some large quartzite cobbles 0-3 feet
Deeper samples may contain some rock flour due to spoon/auger action.

BORING SB2029

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-2
Driller: Layne Christiansen

Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Symbols	Description
0	H	A	0-.5	<1		SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, moist
1	SS	B	1-2	<1			(1-2 feet) Brown silty fine SAND, some silt, much fine to coarse gravel, dry
2	SS	C	2-3	<1			(2-3 feet) SAME AS ABOVE with much fine to coarse gravel, rock flour (quartzite cobbles)
3							
4							
5							
6							

Elevation | Soil Data | Samples

BORING TERMINATED AT 3.0 FEET

Some large quartzite cobbles 0-3 feet
Deeper samples may contain some rock flour due to spoon/auger action.

BORING SB2030

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-2
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, moist
	1	SS	B	1-2	<1				(1-2 feet) Brown silty fine SAND, some silt, trace fine gravel, dry (quartzite cobbles at 2 feet in bottom of spoon)
	2	SS	C	2-3	<1				(2-3 feet) SAME AS ABOVE with much gravel (quartzite cobbles) (rock flour)
	3								BORING TERMINATED AT 3.0 FEET Some large quartzite cobbles 0-3 feet Deeper samples may contain some rock flour due to spoon/auger action.
	4								
	5								
	6								

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BORING SB2031

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-2
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows	per	Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1					SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, moist
	1	SS	B	1-2	<1						(1-2 feet) Brown silty fine SAND, some silt, much fine to coarse gravel, dry (quartzite cobbles) (rock flour)
	2	SS	C	2-3	<1						(2-3 feet) SAME AS ABOVE with much quartzite cobbles, rock flour BORING TERMINATED AT 3.0 FEET Some large quartzite cobbles 0-3 feet Deeper samples may contain some rock flour due to spoon/auger action.
	3										
	4										
	5										
	6										

Soil Data

LOG OF BORING

CMS
A-TEAD
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BORING SB2101

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown to brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, moist
	1	SS	B	1-2	<1				(1-2 feet) SAME AS ABOVE with concrete frag.
	2	SS	C	2-3	<1			SM	(2-3 feet) Light brown silty fine SAND, trace fine gravel, slight moist (slight increase in density) BORING TERMINATED AT 3.0 FEET NOTE: Rounded to subrounded quartz fine gravel fairly uniform throughout site (SWMU 21) from 1-2 feet bgs.
	3								
	4								
	5								
	6								

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BORING SB2102

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Symbols	Description
0	H	A	0-.5	<1		SM/SW	(0-.5 feet) Olive brown silty fine SAND, some silt, trace fine gravel, loose, dry
1	SS	B	1-2	<1		SM/SW	(1-2 feet) SAME AS ABOVE with trace coarse gravel
2	SS	C	2-3	<1		SM/SW	(2-3 feet) SAME AS ABOVE (very slight moist)
3							BORING TERMINATED AT 3.0 FEET
4							
5							
6							

Elevation | Soil Data | Samples

BORING SB2103

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, slight moist
	1	SS	B	1-2	<1				(1-2 feet) SAME AS ABOVE (slight increase in density)
	2	SS	C	2-3	<1			SM	(2-3 feet) Brown silty fine SAND, some silt, less gravel, very slight moist BORING TERMINATED AT 3.0 FEET
	3								
	4								
	5								
	6								

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BORING SB2104

Project: Soil Sampling, *SWMUs 2, 20, 21, 23*
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Symbols	Description
0	H	A	0-.5	<1		SM/SW	(0-.5 feet) Brown silty fine SAND, some silt, much fine gravel, some coarse gravel, trace root matter, slight moist
1	SS	B	1-2	<1		SM/SW	(1-2 feet) SAME AS ABOVE with more gravel (Very large amount of round/subrounded quartz)
2	SS	C	2-3	<1		SM	(2-3 feet) Light brown silty fine SAND, trace fine gravel, slight increase in density, slight moist
3							BORING TERMINATED AT 3.0 FEET
4							
5							
6							

Elevation

Samples

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BORING SB2105

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Symbols	Description
0–1	H	A	0-.5	<1		SM/SW	(0-.5 feet) Brown silty fine SAND, some silt, much fine gravel, some coarse gravel, dry to very slight moist
1–2	SS	B	1-2	<1		SM/SW	(1-2 feet) SAME AS ABOVE with more gravel (Very large amount of quartz gravel)
2–3	SS	C	2-3	<1		SM	(2-3 feet) Light brown silty fine SAND, trace fine gravel, slight increase in density, slight moist

BORING TERMINATED AT 3.0 FEET

Elevation; Depth (Feet) scale 0–6

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BORING SB2106

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, trace root matter, slight moist
	1	SS	B	1-2	<1				(1-2 feet) SAME AS ABOVE with more gravel (wet)
	2	SS	C	2-3	<1			SM	(2-3 feet) Brown silty fine SAND, much fine to coarse gravel, some silt (quartzite cobbles) (dry)
	3								
	4								
	5								
	6								

BORING TERMINATED AT 3.0 FEET

NOTE:
"C" sample contains rock flour due to split spoon action against quartzite cobbles.

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BORING SB2107

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, trace root matter, slight moist
	1	SS	B	1-2	<1				(1-2 feet) Brown silty fine SAND, some silt, fine gravel (quartzite cobbles) (dry)
	2	SS	C	2-3	<1				(2-3 feet) SAME AS ABOVE with much quartzite cobbles BORING TERMINATED AT 3.0 FEET NOTE: "C" sample contains rock flour due to split spoon action against quartzite cobbles.
	3								
	4								
	5								
	6								

BORING SB2108

Project: Soil Sampling, *SWMUs 2, 20, 21, 23*
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Symbols	Description
0	H	A	0-.5	<1		SM/SW	(0-.5 feet) Dark brown silty fine SAND, some silt, much fine gravel, some coarse gravel, slight moist
1	SS	B	1-2	<1		SM/SW	(1-2 feet) SAME AS ABOVE with more gravel
2	SS	C	2-3	<1		SM	(2-3 feet) Light brown silty fine SAND, no gravel, some silt, very slight moist BORING TERMINATED AT 3.0 FEET
3							
4							
5							
6							

Elevation

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BORING SB2109

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, loose, dry
	1	SS	B	1-2	<1				(1-2 feet) SAME AS ABOVE
	2	SS	C	2-3	<1				(2-3 feet) SAME AS ABOVE BORING TERMINATED AT 3.0 FEET
	3								
	4								
	5								
	6								

BORING SB2110

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Brown silty fine SAND, some silt, some fine gravel, trace root matter, loose, slight moist
	1	SS	B	1-2	<1				(1-2 feet) Brown silty fine SAND, trace fine to coarse gravel, loose, dry
	2	SS	C	2-3	<1				(2-3 feet) SAME AS ABOVE with less gravel BORING TERMINATED AT 3.0 FEET
	3								
	4								
	5								
	6								

BORING SB2111

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Symbols	Description
0	H	A	0-.5	<1		SM/SW	(0-.5 feet) Dark brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, trace root matter, slight moist
1	SS	B	1-2	<1		SM/SW	(1-2 feet) Brown silty fine SAND, some silt, little fine gravel, trace coarse sand, very slight moist
2	SS	C	2-3	<1		SM/SW	(2-3 feet) SAME AS ABOVE

BORING TERMINATED AT 3.0 FEET

BORING SB2112

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, trace root matter, slight moist
	1	SS	B	1-2	<1			SM	(1-2 feet) Brown silty fine SAND, some silt, very slight moist
	2	SS	C	2-3	<1				(2-3 feet) SAME AS ABOVE BORING TERMINATED AT 3.0 FEET
	3								
	4								
	5								
	6								

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BORING SB2113

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, trace root matter, slight moist
	1	SS	B	1-2	<1			SM	(1-2 feet) Brown silty fine SAND, some silt, trace fine gravel, very slight moist
	2	SS	C	2-3	<1				(2-3 feet) SAME AS ABOVE with no gravel BORING TERMINATED AT 3.0 FEET
	3								
	4								
	5								
	6								

BORING SB2114

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Symbols	Description
0	H	A	0-.5	<1		SM/SW	(0-.5 feet) Brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, slight moist
1	SS	B	1-2	<1			(1-2 feet) SAME AS ABOVE with more gravel, some coarse gravel (round/subround quartz)
2	SS	NS	2-3	<1			(2-3 feet) NO SAMPLE TAKEN Unable to recover sample due to auger/spoon refusal. Offset boring a few times in an attempt to recover "C" sample. (unsuccessful) (Drill rig chattering-broke teeth off auger head) BORING TERMINATED AT 3.0 FEET
3							
4							
5							
6							

Elevation

Samples

BORING SB2115

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, slight moist
	1	SS	B	1-2	<1			ML	(1-2 feet) Brown sandy SILT, very fine grained, much fine to coarse gravel, slight moist
	2	SS	C	2-3	<1			SM	(2-3 feet) Brown silty fine SAND, much fine to coarse gravel (round/subround quartz), some silt, slight moist
	3								BORING TERMINATED AT 3.0 FEET
	4								
	5								
	6								

BORING SB2116

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows	per	Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1					SM/SW	(0-.5 feet) Dark brown silty fine SAND, some silt, much fine gravel, trace coarse gravel, root matter, slight moist
	1	SS	B	1-2	<1						(1-2 feet) SAME AS ABOVE (no root matter)
	2	SS	C	2-3	<1						(2-3 feet) SAME AS ABOVE with more gravel, moist BORING TERMINATED AT 3.0 FEET
	3										
	4										
	5										
	6										

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BORING SB2117

Project: Soil Sampling, SWMUs 2, 20, 21, 23
Tooele, Utah
Boring Location: See Figure D-5
Driller: Layne Christiansen

Elevation	Depth (Feet)	Sampler Type	Sample Number	Sample Depth	PID (ppm)	Blows per Foot	Samples	Symbols	Description
	0	H	A	0-.5	<1			SM/SW	(0-.5 feet) Dark brown silty fine SAND, some silt, much fine to coarse gravel, root matter, slight moist
	2	SS	C	2-3	<1			SM	(2-3 feet) Brown silty fine SAND, some silt, trace fine gravel, very slight moist
	4	SS	D	4-5	<1				(4-5 feet) SAME AS ABOVE with no gravel

BORING TERMINATED AT 5.0 FEET

Depth scale: 0, 1, 2, 3, 4, 5, 6

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ATTACHMENT B

Chains of Custody

DAMES & MOORE
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7101 Wisconsin Avenue Suite 700
Bethesda, Maryland 20814-4870
(301) 652-2215 Fax: (301) 656-8059

CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: TEAD-SWMU 2,20,21,23

SAMPLER (Signature):

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TAL Metals	Explosives	TCL VOCs	REMARKS
SS2115	12/6/99	1130		X	SOIL	SWMU 21	1	X			
SS2116		1140		X			1	X			
SS2117		1205		X			1	X			
SS2118		1145		X			1	X			
SS2119		1150		X			1	X			
SS2120		1210		X			1	X			
SS2121		1215		X			1	X			
SS2122		1230		X			1	X			
SS2118B		1147		X	H_2O		1	X			
SS2301		1345		X	SOIL	SWMU 23	1	X			HNO_3 PRESERVED
DW120699		1240		X	H_2O	DISTILLED H_2O	4	X	X	X	TAL MET. PRES W/ HNO_3
SW120699		1315		X	H_2O	SOURCE H_2O	4	X	X	X	" " "
TB120699		1200		X	H_2O	TRIP BLANKS	2			X	PRESERVED HCL
											VOCs pres HCL

12/6/99

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	12/6/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To:
				ROSA GWINN (DAMES & MOORE) @ above address

CMS
A-TEAD
D-73

DISTRIBUTION:
White: Accompanies Shipment
Yellow: Project Files
Pink: Field Log
Gold: QA Files

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY
7101 Wisconsin Avenue Suite 700
Bethesda, Maryland 20814-4870
(301) 652-2215 Fax: (301) 656-8059

CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: TEAD-SWMU 2,20,21,23

SAMPLER (Signature):

ANALYSES REQUIRED: TAL METALS

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TAL METALS	REMARKS
SB2110A	12/6/99	1430		X	soil	SWMU 21	1	✓	
SB2110B		1440		X			1	✓	
SB2110C		1445		X			1	✓	
SB2102A		1510		X			1	✓	
SB2102B		1520		X			1	✓	
SB2102BR		1520		X			1	✓	
SB2102C		1525		X			1	✓	
SB2111A		1550		X			1	✓	
SB2111B		1555		X			1	✓	
SB2111C		1600		X			1	✓	ALSO USE "SB2111C" FOR MATRIX SPIKE AND MATRIX SPIKE DUP.
									ID's. = SB2111M "MATRIX SPIKE" SB2111S "MATRIX SPIKE DUP"

12/6/99

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	12/6/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To:
				Rosa Gwinn (DAMES & MOORE) @ above address

CMS
A-TEAD
D-74

DISTRIBUTION:
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DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

7101 Wisconsin Avenue Suite 700
Bethesda, Maryland 20814-4870
(301) 652-2215 Fax: (301) 656-8059

CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: Dames & Moore TEAD SWMU 21

SAMPLER (Signature): [signature]

ANALYSES REQUIRED: TAL METALS

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TAL METALS	REMARKS
SB2109A	12/7/99	0835		X	SOIL	SWMU 21 0-.5'	1	X	ALSO USE "SB2109A"
SB2109B		0840				DEPTHS → 1-2'	1	X	FOR MATRIX SPIKE AND
SB2109C		0850				2-3'	1	X	MATRIX SPIKE DUPLICATE,
SB2101A		0900				0-.5'	1	X	
SB2101AR		0900				0-.5'	1	X	USE ID'S:
SB2101B		0908				1-2'	1	X	"SB2109AM" MATRIX SPIKE
SB2101C		0915				2-3'	1	X	"SB2109AS" MATRIX SPIKE DUPL
SB2103A		0920				0-.5'	1	X	
SB2103B		0925				1-2'	1	X	
SB2103C		0935				2-3'	1	X	ALSO USE "SB2104B"
SB2104A		1005				0-.5'	1	X	FOR MATRIX SPIKE AND
SB2104B		1025				1-2'	1	X	MATRIX SPIKE DUPLICATE
SB2104C		1035				2-3'	1	X	
SB2105A		0940				0-.5'	1	X	USE ID'S:
SB2105AB		0942			H_2O		1	X	"SB2104BM" MATRIX SPIKE
SB2105B		1015			SOIL	1-2'	1	X	"SB2104BS" MATRIX SPIKE
SB2105C		1020				2-3'	1	X	DUPLICATE
SB2114A		1047				0-.5'	1	X	
SB2114B		1255				1-2'	1	X	

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[signature]	12/7/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To:
				Rosa Gwinn Dames & Moore @ above address

A-TEAD
D-75
CMS

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CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: Dames & Moore TEAD - SWMU 21

SAMPLER (Signature):

ANALYSES REQUIRED: TAL METALS, EXPLOSIVES

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TAL METALS	EXPLOSIVES	REMARKS
~~[illegible]~~										
SB2115A	12/7/99	1124		X	SOIL	SWMU 21 0-.5'	1	X		
SB2115B		1355				DEPTHS → 1-2'	1	X		
SB2115C		1405				2-3'	1	X		
SB2116A		1133				0-.5'	1	X		
SB2116B		1430				1-2'	1	X		
SB2116C		1435				2-3'	1	X		
SB2108A		1150				0-.5'	1	X		
SB2108B		1500				1-2'	1	X		
SB2108C		1505				2-3'	1	X		
SB2106A		0945				0-.5'	1	X		
SB2107A		1000				0-.5'	1	X		
SB2112A		0842				0-.5'	1	X		
SB2113A		0922				0-.5'	1	X		
SB2117A		1018				0-.5'	2	X	X	
SB2117AB		1019			H_2O		2	X	X	
SB2108AR	12/7/99	1150			SOIL	0-.5'	1	X		

12/7/99

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	12/7/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To:
				ROSA GWINN DAMES & MOORE @ above address

DISTRIBUTION:
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A-TEAD
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(301) 652-2215 Fax: (301) 656-8059

CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: Dames & Moore TEAD - SWMU 21 + 20

SAMPLER (Signature): [signature] D+M

ANALYSES REQUIRED: TAL Metals, EXPLOSIVES, Sb/Pb

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TAL Metals	EXPLOSIVES	Sb/Pb	REMARKS
SB2106B	12/8/99	0910		X	SOIL	SWMU 21 1-2'	1	X			
SB2106C		0915		X		DEPTHS: 2-3'	1	X			
SB2107B		0840		X		1-2'	1	X			
SB2107C		0850		X		2-3'	1	X			
SB2112B		0945		X		1-2'	1	X			
SB2112C		0955		X		2-3'	1	X			
SB2113B		0925		X		1-2'	1	X			
SB2113C		0930		X		2-3'	1	X			
SB2117C		1010		X		2-3'	2	X	X		
SB2117D		1015		X		4-5'	2	X	X		
SB2030A	12/8/99	1150		X	SOIL	SWMU 20 0-.5'	1			X	
SB2030B		1330		X		1-2'	1			X	
SB2030C		1345		X		2-3'	1			X	
SB2024A		1120		X		0-.5'	1			X	
SB2024B		1400		X		1-2'	1			X	
SB2024C		1405		X		2-3'	1			X	
SB2027A		1135		X		0-.5'	1			X	
SB2027B		1415		X		1-2'	1			X	
SB2027C		1450		X		2-3'	1			X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12/8/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To:
				ROSA GWINN @ Dames & Moore above address

CMS
A-TEAD
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(301) 652-2215 Fax: (301) 656-8059

CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: Dames & Moore TEAD-SWMU 20

SAMPLER (Signature):

ANALYSES REQUIRED: Pb/Sb

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	Pb/Sb	REMARKS
SB2021BR	12/8/99	1415		X	SOIL	SWMU20 1-2'	1	X	
SB2022A		1110		X		DEPTHS: 0-.5'	1	X	ALSO USE "SB2022A"
SB2022B		1515		X		1-2'	1	X	FOR MS/MSD
SB2022C		1520		X		2-3'	1	X	
SB2026A		1130		X		0-.5'	1	X	ID'S:
SB2026B		1535		X		1-2'	1	X	"SB2022AM" MATRIXSPIKE
SB2026C		1555		X		2-3'	1	X	"SB2022AS" MATRIXSPIKE DUPL.
SB2021A		1105		X		0-.5'	1	X	
SB2023A		1115		X		0-.5'	1	X	
SB2025A		1125		X		0-.5'	1	X	
SB2028A		1140		X		0-.5'	1	X	
SB2029A		1145		X		0-.5'	1	X	
SB2031A		1155		X		0-.5'	1	X	

12/8/99

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	12/8/99 1700				

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				ROSA GWINN @above address (Dames & Moore)

CMS
A-TEAD
D-78

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CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: DAMES & MOORE TEAD SWMU 20 + 23

SAMPLER (Signature): [illegible]

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	Sb/Pb	TAL Metals (incl. Sb/Pb)	EXPLOSIVES	TCL VOC'S						REMARKS
SBZ029B	12/9/99	0830		X	SOIL	SWMU 20 1-2'	1	X									
SBZ029C	|	0845		X	↓	DEPTHS: 2-3'	1	X									ALSO USE "SBZ021C"
SBZ029CB	|	0855		X	H_2O		2		X	X							FOR MATRIX SPIKE AND
SBZ031B	|	0915		X	SOIL	1-2'	1	X									MATRIX SPIKE DUPLICATE
SBZ031C	|	0925		X	|	2-3'	1	X									
SBZ023B	|	1000		X	|	1-2'	1	X									USE ID'S:
SBZ023C	|	1015		X	|	2-3'	1	X									"SBZ021CM" MATRIX SPIKE
SBZ025B	|	1035		X	|	1-2'	1	X									"SBZ021CS" MATRIX SPIKE DUPL
SBZ025C	|	1040		X	|	2-3'	1	X									
SBZ025BR	|	1035		X	|	1-2'	1	X									
SBZ028B	|	1100		X	|	1-2'	1	X									
[redacted]																	
SBZ021B	|	1145		X	|	1-2'	1	X									
SBZ021C	|	1155		X	↓	2-3'	1	X									
SBZ021CB	↓	1210		X	H_2O		1	X									
						SWMU23											
SBZ306A	12/9/99	1345		X	SOIL	0-.5'	1				X						
SBZ306B	|	1415		X	|	4-5'	1				X						
SBZ302A	↓	1500		X	↓	0-.5'	1				X						

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[illegible]	12/9/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To:
				ROSA GWINN @ above address (D&M)

CMS
A-TEAD
D-79

DISTRIBUTION:
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CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: Dames & Moore TEAD -SWMU23

SAMPLER (Signature):

ANALYSES REQUIRED: TCL VOC's

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TCL VOC's	REMARKS
SB2302B	12/9/99	1510		X	SOIL	SWMU23 3-4'	1	X	
SB2302C	↓	1535		X	↓	DEPTHS: 6-7'	1	X	
SB2302D	↓	1545		X	↓	9-10'	1	X	
TB120999	12/9/99	1200		X	H_2O		2	X	

12/9/99

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	12/9/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To:
				Rosa Gwinne above address (D&M)

CMS
A-TEAD
D-80

DISTRIBUTION:
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CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: DAMES & MOORE TEAD SWMU 23

SAMPLER (Signature):

ANALYSES REQUIRED

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TCL VOCs	Sb/Pb	REMARKS
SB2305A	12/11/99	0920		X	SOIL	SWMU 23 0-.5'	1	X		
SB2305B		0930		X		DEPTHS: 3-4'	1	X		ALSO USE "SB2301B"
SB2305C		0945		X		6-7'	1	X		FOR MATRIX SPIKE/
SB2305D		0955		X		9-10'	1	X		MATRIX SPIKE DUPL.
SB2301A		1030		X		0-.5'	1	X		
SB2301B		1040		X		3-4'	1	X		USE ID's:
SB2301C		1050		X		6-7'	1	X		"SB2301BM" MATRIX SPIKE
SB2301D		1100		X		9-10'	1	X		"SB2301BS" MATRIX SPIKE DUPL.
TB121199		1105		X	H_2O		2	X		
SB2303A		1125		X	SOIL	0-.5'	1	X		
SB2303AR		1125		X		0-.5'	1	X		
SB2303B		1140		X		3-4'	1	X		
SB2303C		1145		X		6-7'	1	X		
SB2303D		1155		X		9-10'	1	X		
SB2303DB		1205		X	H_2O		3	X	X	
SB2304A		1215		X	SOIL	0-.5'	1	X		
SB2304B		1230		X		3-4'	1	X		
SB2304C		1240		X		6-7'	1	X		
SB2304D		1255		X		9-10'	1	X		

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	12/13/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To:
				ROSA GWINNE ABOVE ADDRESS

A-TEAD
D-81

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Bethesda, Maryland 20814-4870
(301) 652-2215 Fax: (301) 656-8059

CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: Dames & Moore TEAD - SWMU 23

SAMPLER (Signature): [illegible]

ANALYSES REQUIRED

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TCL VOCs	REMARKS
SB2306C	12/11/99	1320		X	SOIL	SWMU23 6-7'	1	X	
SB2306D	↓	1330		X	SOIL	DEPTHS: 9-10'	1	X	

[illegible] 12/11/99

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[illegible]	12/13/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To:
				ROSA GWINN @ ABOVE ADDRESS (D & M)

A-TEAD CMS D-82

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(301) 652-2215 Fax: (301) 656-8059

CHAIN-OF-CUSTODY RECORD

JOB NO: 09604-056

PROJECT NAME-CLIENT: DAMES & MOORE TEAD SWMU 2

SAMPLER (Signature):

ANALYSES REQUIRED: TCL VOCs, TAL METALS

SAMPLE NO.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TCL VOCs	TAL METALS	REMARKS
SB0215A	12/12	1340		X	SOIL	SWMU 2 0-.5'	2	X	X	USE "SB2017A" FOR
SB0215B		1420		X		3.7-4.7'	2	X	X	MATRIX SPIKE AND MATRIX
SB0215C		1425		X		4.7-5.7	1		X	SPIKE DUPLICATE.
SB0217A		1505		X		0-.5'	2	X	X	
SB0217B		1530		X		4-5'	2	X	X	USE ID'S;
SB0217C		1535		X		5-6'	1		X	
TB021799		1540		X	H_2O		2	X		"SB2017AM" MATRIX SPIKE
SB0217CB		1545		X	H_2O		3	X	X	"SB2017AS" MATRIX SPIKE DUP
SB0218B		1635		X	SOIL	3.5-4.5	2	X	X	
SB0218C		1640		X	SOIL	4.5-5.1'	1		X	

12/12/99

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	12/13/99 1700				

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Report Results To: ROSA GWINN @ above address (D&M)

DISTRIBUTION:
White: Accompanies Shipment
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A-TEAD D-83 CMS

CHAIN-OF-CUSTODY RECORD

№ 798

JOB NO: 09604-056

PROJECT NAME–CLIENT: TEAD SWMU2

SAMPLER (Signature): [signature]

ANALYSES REQUESTED: TCL VOCS, TAL METALS

Sample No.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TCL VOCS	TAL METALS	REMARKS
SB0220B	12/13	1115		X	SOIL	SWMU2 4-4.8'	2	X	X	
SB0220C	↓	1120		X	↓	DEPTHS: 4.8-5.2'	1		X	
SB0216B		1415		X		3.1-4.1'	2	X	X	
SB0216C		1425		X	↓	4.1-4.8'	1		X	
TB121399		0800		X	H_2O		2	X		
SB0216EB	↓	1450		X	H_2O		3	X	X	

[signature] 12/13/99

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[signature]	12/13/99 1700				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks: ROSAGWINN (D&M) Report Results to	

DISTRIBUTION:
White: Accompanies Shipment
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CMS
A-TEAD
D-84

Dames & Moore

CHAIN-OF-CUSTODY RECORD

№ 781

JOB NO: 09604-056

PROJECT NAME—CLIENT: DAMES & MOORE TEAD SWMU 20, 21, 23

SAMPLER (Signature): [signature]

Sample No.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TCLP VOCs	TCLP SVOCs	TCLP METALS	EXPLOSIVES						REMARKS
SC2001	12/12	1010	X	[redacted]	SOIL	SWMU20 DRUMCUTTINGS	2	X	X	X							COMPOSITE SOIL CUTTING
SC2101	↓	1000	X		↓	SWMU21 DRUMCUTTINGS	3	X	X	X	X						SAMPLES OF ALL BORING
SC2301	↓	1025	X		↓	SWMU23 DRUMCUTTINGS	2	X	X								HOLES @ EACH SWMU.

ANALYSES REQUESTED

[signature] 12/12/99

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[signature]	12/13/99 1700				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks: Results to Rosa Gwinn (CD&M)	

A-TEAD
D-85
CMS

DISTRIBUTION:
- White: Accompanies Shipment
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Dames & Moore

CHAIN-OF-CUSTODY RECORD

№ 797

JOB NO: 09604-056

PROJECT NAME—CLIENT: Dames + Moore
TEAD - SWMU 2

SAMPLER (Signature):

Sample No.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TCL VOCs	TAL Metals	REMARKS
SB0219A	12/14	0830		X	SOIL	SWMU 2 0-.5'	2	X	X	
SB0219AR		0830		X		DEPTHS: 0-.5'	2	X	X	
SB0219B		0840		X		3.0-3.7'	2	X	X	
SB0219C		0850		X		3.7-4.7'	1		X	
TB121499	12/14	0800		X	H_2O		2	X		
SB0219CB		0910		X	H_2O		3	X	X	
SB0214A		1000		X	SOIL	0-.5'	2	X	X	
SB0214B		1035		X		3.7-4.7'	2	X	X	
SB0214C		1040		X		4.7-5.5'	1		X	
SB0213B		1210		X		3.7-4.7'	2	X	X	
SB0213C		1215		X		4.7-5.5'	1		X	
SB0212A		1255		X		0-0.5'	2	X	X	
SB0212B		1345		X		4-5'	2	X	X	
SB0212C		1410		X		5-6.2'	1		X	
SB0211B		1500		X		4-5'	2	X	X	
SB0211C		1505		X		5-6'	1		X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	12/14/99 1700				

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks:
				Report Results to: ROSA GWINN (D&M)

DISTRIBUTION:
White: Accompanies Shipment
Yellow: Project Files
Pink: Field Log
Gold: QA Files

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Dames & Moore

CHAIN-OF-CUSTODY RECORD

№ 796

JOB NO: 09604-056

PROJECT NAME—CLIENT: Dames+Moore TEAD - SWMU 2,20,21,25

SAMPLER (Signature): [illegible signature]

Sample No.	Date	Time	Comp.	Grab	Matrix	Station Number and Location	Total No. of Containers	TCLP VOCs	TCLP SVOCs	TCLP Metals	F-listed solvents	Reactivity	TOX	TOC	Pest/Herb (TCLP)	EXPLOSIVES	REMARKS
SC0201	12/14	1630	X		SOIL	SWMU 2 DRUM CUTT.	2	X	X	X							
DECW01	12/14	1645	X		H_2O	DECON H_2O DRUMS COMP	13	X	X	X	X	X	X	X	X	X	
TBDECW	12/14	1640		X	H_2O	TRIP BLANK - Decon H_2O	2	X									

[illegible signature] 12/14/99

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
[illegible signature]	12/14/99 1700				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks: Report results to: ROSA GWINN (D&M)	

DISTRIBUTION:
- White: Accompanies Shipment
- Yellow: Project Files
- Pink: Field Log
- Gold: QA Files

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ATTACHMENT C

Chemical Data

Tooele Army Depot

Data Tables

Key to Abbreviations

Analytes

HMX	Cyclotetramethylenetetranitramine
RDX	Cyclotrimethylenetrinitramine
TETRYL	N-Methyl-N,2,4,6-Tetranitroaniline

Headings

EXP	Explosives
METALTOT	Metals in soils
VOC	Volatile Organic Compounds
L	Laboratory flag column heading
V	Data Validation flag column heading
R	Data validation Reason code flag column heading
FT	Foot or Feet

Results

UGG	Micrograms per Gram
UGL	Micrograms per Liter
LT	Less Than the certified reporting limit or method detection limit
NT	Analyte was Not Tested for the specified sample location, date, and depth

Results - Laboratory Flags

D Duplicate analysis. Only the second (duplicate) sample is flagged

J Value is estimated because of one of the following conditions:
(1) Interferences in the sample (use with Flag J or I)
(2) The value is below the method detection level but above the instrumental detection level (use with Flag J or P)
(3) The value is above the upper reporting level of the method (use with Flag J or X)

P The value is below the method detection level but above the instrumental detection level

S Non-target compound analyzed for and detected. Also used to report tentatively identified compounds, which are quantitated against an internal standard

U Analysis is unconfirmed

Tooele Army Depot

Data Tables

Key to Abbreviations

Results - Validation Flags

J	The datum should be considered an estimated value, more highly biased or variable than normal
R	The datum is unusable due to serious quality control failures
U	The datum should be considered a non-detect at the value reported due to blank contamination
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate

Results - Reason Codes

c	Calibration failure; poor or unstable response
d	Matrix spike / Matrix spike duplicate or Laboratory duplicate imprecision
m	Matrix spike / Matrix spike duplicate recovery failure
o	Calibration blank contamination
p	Preparation blank contamination
r	Linearity failure in initial calibration
z	Method blank contamination

SWMU 20 Chemical Data – Soil

Data Summary Report For: SWMU 20
Chemical Analysis Data
SOIL

Sample No:		SB2021A		SB2021B		SB2021C		SB2022A		SB2022B	
Date Sampled:		12/8/99		12/9/99		12/9/99		12/8/99		12/8/99	
Depth:		0 - 0.5 FT		1 - 2 FT		2 - 3 FT		0 - 0.5 FT		1 - 2 FT	
ANALYTE	UNITS		L V R		L V R		L V R		L V R		L V R
METALTOT											
ANTIMONY	UGG	2.21		LT 1	J m	LT 1	J m	5.48		7.92	
LEAD	UGG	191		27	J m	5.08	J m	80.6		244	

CMS
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D-95

Data Summary Report For: SWMU 20
Chemical Analysis Data
SOIL

		SB2022C				SB2023A				SB2023B				SB2023C				SB2024A			
Sample No:		SB2022C				SB2023A				SB2023B				SB2023C				SB2024A			
Date Sampled:		12/8/99				12/8/99				12/9/99				12/9/99				12/8/99			
Depth:		2 - 3 FT				0 - 0.5 FT				1 - 2 FT				2 - 3 FT				0 - 0.5 FT			
ANALYTE	UNITS		L	V	R		L	V	R		L	V	R		L	V	R		L	V	R
METALTOT																					
ANTIMONY	UGG	1.47				LT 1				LT 1		UJ	m	LT 1		UJ	m	3.09			
LEAD	UGG	17.3				13.8				11.6		J	m	5.49		J	m	66.7			

CMS
A-TEAD
D-96

Data Summary Report For: SWMU 20
Chemical Analysis Data
SOIL

Sample No:		SB2024B		SB2024C		SB2025A		SB2025B		SB2025BR	
Date Sampled:		12/8/99		12/8/99		12/8/99		12/9/99		12/9/99	
Depth:		1 - 2 FT		2 - 3 FT		0 - 0.5 FT		1 - 2 FT		1 - 2 FT	
ANALYTE	UNITS		L V R		L V R		L V R		L V R		L V R
METALTOT											
ANTIMONY	UGG	LT 1		LT 1		3.28		LT 1	J m	LT 1	UJ m
LEAD	UGG	6.18		6.11		36		15.6	J m	11.6	J m

CMS
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Data Summary Report For: SWMU 20
Chemical Analysis Data
SOIL

		SB2025C				SB2026A				SB2026B				SB2026C				SB2027A			
Sample No:		SB2025C				SB2026A				SB2026B				SB2026C				SB2027A			
Date Sampled:		12/9/99				12/8/99				12/8/99				12/8/99				12/8/99			
Depth:		2 - 3 FT				0 - 0.5 FT				1 - 2 FT				2 - 3 FT				0 - 0.5 FT			
ANALYTE	UNITS		L	V	R		L	V	R		L	V	R		L	V	R		L	V	R
METALTOT																					
ANTIMONY	UGG	LT 1		J	m	1.05				LT 1				LT 1				3.3			
LEAD	UGG	11.3		J	m	27.6				7.94				6.26				80.3			

CMS
A-TEAD
D-98

Data Summary Report For: SWMU 20
Chemical Analysis Data
SOIL

		SB2027B					SB2027BR					SB2027C					SB2028A					SB2028B				
Sample No:		SB2027B					SB2027BR					SB2027C					SB2028A					SB2028B				
Date Sampled:		12/8/99					12/8/99					12/8/99					12/8/99					12/9/99				
Depth:		1 - 2 FT					1 - 2 FT					2 - 3 FT					0 - 0.5 FT					1 - 2 FT				
ANALYTE	UNITS			L	V	R			L	V	R			L	V	R			L	V	R			L	V	R
METALTOT																										
ANTIMONY	UGG		1.35					4.04				LT	1				LT	1				LT	1	UJ	m	
LEAD	UGG		13.6					123					5.94					19.6					7.86	J	m	

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D-99

Data Summary Report For: SWMU 20
Chemical Analysis Data
SOIL

		SB2029A		SB2029B		SB2029C		SB2030A		SB2030B	
Sample No:		SB2029A		SB2029B		SB2029C		SB2030A		SB2030B	
Date Sampled:		12/8/99		12/9/99		12/9/99		12/8/99		12/8/99	
Depth:		0 - 0.5 FT		1 - 2 FT		2 - 3 FT		0 - 0.5 FT		1 - 2 FT	
ANALYTE	UNITS		L V R		L V R		L V R		L V R		L V R
METALTOT											
ANTIMONY	UGG	1.45		LT 1	UJ m	LT 1	UJ m	2.06		1.32	
LEAD	UGG	25.3		7.47	J m	6.48	J m	81.1		8.21	

CMS
A-TEAD
D-100

Data Summary Report For: SWMU 20
Chemical Analysis Data
SOIL

	Sample No:	SB2030C	SB2031A	SB2031B	SB2031C
	Date Sampled:	12/8/99	12/8/99	12/9/99	12/9/99
	Depth:	2 - 3 FT	0 - 0.5 FT	1 - 2 FT	2 - 3 FT
ANALYTE	UNITS	L V R	L V R	L V R	L V R
METALTOT					
ANTIMONY	UGG	LT 1	LT 1	LT 1 J m	LT 1 J m
LEAD	UGG	5.75	26.9	6.5 J m	6.26 J m

CMS
A-TEAD
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SWMU 21 Chemical Data – Soil

Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

ANALYTE	UNITS	SB2101A		SB2101AR		SB2101B		SB2101C		SB2102A	
Date Sampled:		12/7/99		12/7/99		12/7/99		12/7/99		12/6/99	
Depth:		0 - 0.5 FT		0 - 0.5 FT		1 - 2 FT		2 - 3 FT		0 - 0.5 FT	
			L V R		L V R		L V R		L V R		L V R
METALTOT											
ALUMINUM	UGG	10600		10600		8230		3590		5930	
ANTIMONY	UGG	2.02		1.97		16.2		2.76		14.7	
ARSENIC	UGG	5.25		5.59		6.42		4.34		3.83	
BARIUM	UGG	148		132		240		72		178	
BERYLLIUM	UGG	0.47	JP	0.488	JP	0.382	JP	0.215	JP	0.302	JP
CADMIUM	UGG	1.89		1.09		33.5		LT 0.2		12	
CALCIUM	UGG	6560		5690		11500		52100		8630	
CHROMIUM	UGG	12.7		12.1		13.3		5.75		10.6	
COBALT	UGG	4.72	JP	4.1	JP	4.24	JP	3.17	JP	3.71	JP
COPPER	UGG	75.9		38.1		158		3.47		98.9	
IRON	UGG	10200		10500		8760		5390		6720	
LEAD	UGG	110		45.5		461		5.5		320	
MAGNESIUM	UGG	5520		5610		5310		4200		3470	
MANGANESE	UGG	346		360		246		64.2		195	
MERCURY	UGG	LT 0.05		LT 0.05		LT 0.05		LT 0.05		LT 0.05	
NICKEL	UGG	11.5		10.5		7.21		3.53	JP	6.61	
POTASSIUM	UGG	3560		3550		2510		861		1930	
SELENIUM	UGG	LT 0.5		LT 0.5		LT 0.5		LT 0.5		LT 0.5	
SILVER	UGG	1.34		LT 1		1.78		LT 1		0.848	JP
SODIUM	UGG	192		195		128		142		93.7	
THALLIUM	UGG	LT 1		LT 1		LT 1		LT 1		LT 1	
VANADIUM	UGG	21.8		22.2		17.6		13.9		15.9	
ZINC	UGG	105		68.4		431		13.4		258	

CMS
A-TEAD
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Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

		Sample No: SB2102B		Sample No: SB2102BR		Sample No: SB2102C		Sample No: SB2103A		Sample No: SB2103B	
		Date Sampled: 12/6/99		12/6/99		12/6/99		12/7/99		12/7/99	
		Depth: 1 - 2 FT		1 - 2 FT		2 - 3 FT		0 - 0.5 FT		1 - 2 FT	
ANALYTE	UNITS	L	V R	L	V R	L	V R	L	V R	L	V R
METALTOT											
ALUMINUM	UGG		4310		5270		2810		9190		8390
ANTIMONY	UGG	LT	1	LT	1	LT	1		84.5		28.6
ARSENIC	UGG		3.65		3.52		4.75		6.27		5.24
BARIUM	UGG		58		68.6		42.8		1500		204
BERYLLIUM	UGG		0.246 JP		0.289 JP		0.178 JP		0.384 JP		0.38 JP
CADMIUM	UGG	LT	0.2	LT	0.2	LT	0.2		37.9		3.35
CALCIUM	UGG		20700		23900		15600		27400		32900
CHROMIUM	UGG		6.88		6.86		5.12		29		64.1
COBALT	UGG		3.89 JP		3.47 JP		3.77 JP		6.18		4.2 JP
COPPER	UGG		8.19		5.44		3.54		1060		110
IRON	UGG		5670		6050		4800		13700		9060
LEAD	UGG		6.14		4.65		4.69		6500		163
MAGNESIUM	UGG		2420		2940		1390		5730		5270
MANGANESE	UGG		108		128		78.6		255		208
MERCURY	UGG	LT	0.05	LT	0.05	LT	0.05	LT	0.05	LT	0.05
NICKEL	UGG		6.51		6.23		3.59 JP		17.4		10
POTASSIUM	UGG		1300		1640		693		2840		3010
SELENIUM	UGG	LT	0.5	LT	0.5	LT	0.5	LT	0.5	LT	0.5
SILVER	UGG	LT	1	LT	1	LT	1		3.76	LT	1
SODIUM	UGG		72.3		89.1		75.7		136		156
THALLIUM	UGG	LT	1	LT	1	LT	1	LT	1	LT	1
VANADIUM	UGG		14.3		16.2		12.8		17.7		20.9
ZINC	UGG		20.2		20.1		17		1700		162

CMS
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D-106

Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

ANALYTE	UNITS	SB2103C 12/7/99 2 - 3 FT	L V R	SB2104A 12/7/99 0 - 0.5 FT	L V R	SB2104B 12/7/99 1 - 2 FT	L V R	SB2104C 12/7/99 2 - 3 FT	L V R	SB2105A 12/7/99 0 - 0.5 FT	L V R
METALTOT											
ALUMINUM	UGG	5440		5840		9610		4620		14300	
ANTIMONY	UGG	LT 1		137		1.35		LT 1		129	
ARSENIC	UGG	4.78		5.27		4.42		4.19		8.25	
BARIUM	UGG	63		808		115		63.8		1630	
BERYLLIUM	UGG	0.27	JP	0.188	JP	0.463	JP	0.226	JP	0.365	JP
CADMIUM	UGG	LT 0.2		40.8		0.225		LT 0.2		82	
CALCIUM	UGG	19600		39900		26700		33800		26600	
CHROMIUM	UGG	5.49		48.2		16.9		5.08		75.6	
COBALT	UGG	3.11	JP	3.89	JP	4.66	JP	3.25	JP	8.04	
COPPER	UGG	6.28		695		9.93		4.39		3430	
IRON	UGG	6360		17900		9630		5600		17400	
LEAD	UGG	6.3		5920		1.31		4.47		8250	
MAGNESIUM	UGG	3810		5580		6000		3580		6480	
MANGANESE	UGG	138		192		272		106		296	
MERCURY	UGG	LT 0.05		LT 0.05		LT 0.05		LT 0.05		0.0632	
NICKEL	UGG	5.25		31.3		8.31		4.21	JP	35.4	
POTASSIUM	UGG	1540		1160		3380		1210		2770	
SELENIUM	UGG	LT 0.5		LT 0.5		LT 0.5		LT 0.5		LT 0.5	
SILVER	UGG	0.964	JP	2.64		LT 1		LT 1		4.17	
SODIUM	UGG	137		76.6		158		114		155	
THALLIUM	UGG	LT 1		LT 1		LT 1		LT 1		LT 1	
VANADIUM	UGG	14.9		10.8		21.9		13.5		17.6	
ZINC	UGG	21.4		992		38.3		17.7		3060	

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A-TEAD
D-107

Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

	Sample No:	SB2105B	SB2105C	SB2106A	SB2106B	SB2106C
	Date Sampled:	12/7/99	12/7/99	12/7/99	12/8/99	12/8/99
	Depth:	1 - 2 FT	2 - 3 FT	0 - 0.5 FT	1 - 2 FT	2 - 3 FT
ANALYTE	UNITS	L V R	L V R	L V R	L V R	L V R
METALTOT						
ALUMINUM	UGG	9160	5970	9680	6170	8550
ANTIMONY	UGG	65.6	LT 1	82.1	5.41 J m	1.44 J m
ARSENIC	UGG	5.48	3.44	7.11	5.54	5.51
BARIUM	UGG	693	70.5	734	116 J m	97.6 J m
BERYLLIUM	UGG	0.347 JP	0.284 JP	0.239 JP	0.291 JP	0.39 JP
CADMIUM	UGG	38.2	LT 0.2	34.1	4.61 J m	0.535 J m
CALCIUM	UGG	37300	25300	26900	27600 J m	20500 J m
CHROMIUM	UGG	46.8	7.61	23.7	9.49 J m	71.9 J m
COBALT	UGG	5.31	2.81 JP	3.66 JP	3.41 JP J m	4.09 JP J m
COPPER	UGG	820	5.19	782	37.5	17.7
IRON	UGG	12100	6680	6750	6340	8910
LEAD	UGG	4560	5.24	1640	152 J m	26.3 J m
MAGNESIUM	UGG	5910	3570	4970	4830 J m	4090 J m
MANGANESE	UGG	226	128	190	192 J m	187 J m
MERCURY	UGG	LT 0.05	LT 0.05	0.0762	LT 0.05	LT 0.05
NICKEL	UGG	15.5	5.64	26.7	6.35 J m	7.15 J m
POTASSIUM	UGG	2590	1660	1480	1900 J m	2570 J m
SELENIUM	UGG	LT 0.5	LT 0.5	LT 0.5	LT 0.5	LT 0.5
SILVER	UGG	5.06	0.884 JP	16.1	LT 1	1.14
SODIUM	UGG	132	133	95.7	103 UJ m	128 UJ m
THALLIUM	UGG	LT 1	LT 1	LT 1	LT 1	LT 1 J d
VANADIUM	UGG	17.2	15.6	12.2	14.2 J m	21.7 J m
ZINC	UGG	1120	22.7	710	88.1 J m	37.4 J m

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A-TEAD
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Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

	Sample No:	SB2107A	SB2107B	SB2107C	SB2108A	SB2108AR
	Date Sampled:	12/7/99	12/8/99	12/8/99	12/7/99	12/7/99
	Depth:	0 - 0.5 FT	1 - 2 FT	2 - 3 FT	0 - 0.5 FT	0 - 0.5 FT
ANALYTE	UNITS	L V R	L V R	L V R	L V R	L V R
METALTOT						
ALUMINUM	UGG	5960	14400	7320	16100	14600
ANTIMONY	UGG	10.8	LT 1 UJ m	LT 1 UJ m	95.9	128
ARSENIC	UGG	7.59	5.37	3.79	7.34	8.34
BARIUM	UGG	260	170 UJ m	85.2 UJ m	1570	2340
BERYLLIUM	UGG	0.285 JP	0.668	0.367 JP	0.28 JP	0.335 JP
CADMIUM	UGG	24.5	0.254 J m	LT 0.2 J m	88.8	105
CALCIUM	UGG	31000	33600 J m	21200 J m	44200	59800
CHROMIUM	UGG	10.4	14 J m	17.6 J m	87.6	67.8
COBALT	UGG	2.98 JP	7.16 J m	3.95 JP J m	5.1 JP	5.26
COPPER	UGG	212	12.1	8.44	5510	3030
IRON	UGG	6550	12500	7170	13100	11700
LEAD	UGG	329	9.06 J m	7.79 J m	6280	4400
MAGNESIUM	UGG	6460	9790 J m	4320 J m	8550	9910
MANGANESE	UGG	218	411 J m	174 J m	189	194
MERCURY	UGG	0.446	LT 0.05	LT 0.05	LT 0.05	LT 0.05
NICKEL	UGG	9.14	9.47 J m	6.95 J m	72.7	57.9
POTASSIUM	UGG	2010	5050 J m	2350 J m	1610	1340
SELENIUM	UGG	LT 0.5	LT 0.5	LT 0.5	0.551	LT 0.5
SILVER	UGG	LT 1	LT 1	LT 1	2.56	2.37
SODIUM	UGG	129	300 UJ m	162 UJ m	314	272
THALLIUM	UGG	LT 1	LT 1 J d	LT 1 J d	LT 1	LT 1
VANADIUM	UGG	12.6	29.4 J m	16.8 J m	12.7	11.1
ZINC	UGG	258	46.5 J m	26.2 J m	4950	3250

CMS
A-TEAD
D-109

Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

		Sample No:	SB2108B	SB2108C	SB2109A	SB2109B	SB2109C
		Date Sampled:	12/7/99	12/7/99	12/7/99	12/7/99	12/7/99
		Depth:	1 - 2 FT	2 - 3 FT	0 - 0.5 FT	1 - 2 FT	2 - 3 FT
ANALYTE	UNITS		L V R	L V R	L V R	L V R	L V R
METALTOT							
ALUMINUM	UGG		15000	2640	10100	9890	4900
ANTIMONY	UGG		9.37	LT 1	21.9	154	4.36
ARSENIC	UGG		6.5	3.15	5.82	8.49	3.97
BARIUM	UGG		201	47.8	260	2170	75.8
BERYLLIUM	UGG		0.684	0.165 JP	0.506 JP	0.358 JP	0.275 JP
CADMIUM	UGG		8.07	LT 0.2	58.4	51.1	0.724
CALCIUM	UGG		13200	32900	31800	48500	21800
CHROMIUM	UGG		18.7	4.38	12.5	33.4	6.06
COBALT	UGG		7.03	2.07 JP	4.67 JP	5.09 JP	2.19 JP
COPPER	UGG		95.6	3.07	151	6240	17.5
IRON	UGG		13100	4140	10300	10900	5800
LEAD	UGG		465	4.38	486	3820	33
MAGNESIUM	UGG		8530	3200	6510	6250	3500
MANGANESE	UGG		472	74.5	299	257	138
MERCURY	UGG		LT 0.05	LT 0.05	LT 0.05	LT 0.05	LT 0.05
NICKEL	UGG		14.2	2.73 JP	9.69	16.5	5.44
POTASSIUM	UGG		5240	613	3650	2370	1490
SELENIUM	UGG		LT 0.5	LT 0.5	LT 0.5	LT 0.5	LT 0.5
SILVER	UGG		1.14 JP	LT 1	1.54	5.07	1.08
SODIUM	UGG		308	181	141	109	104
THALLIUM	UGG		LT 1	LT 1	LT 1	LT 1	LT 1
VANADIUM	UGG		29.5	10.2	19.1	14.7	10.8
ZINC	UGG		108	11.5	433	2570	34.1

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Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

ANALYTE	UNITS	SB2110A	SB2110B	SB2110C	SB2111A	SB2111B
Sample No:		SB2110A	SB2110B	SB2110C	SB2111A	SB2111B
Date Sampled:		12/6/99	12/6/99	12/6/99	12/6/99	12/6/99
Depth:		0 - 0.5 FT	1 - 2 FT	2 - 3 FT	0 - 0.5 FT	1 - 2 FT
		L V R	L V R	L V R	L V R	L V R
METALTOT						
ALUMINUM	UGG	7720	5960	3560	13700	5560
ANTIMONY	UGG	35.1	1.82	LT 1	7.8	LT 1
ARSENIC	UGG	4.41	3.84	3.93	39.5	5.24
BARIUM	UGG	525	71.6	51.2	333	60.6
BERYLLIUM	UGG	0.353 JP	0.308 JP	0.233 JP	0.665	0.248 JP
CADMIUM	UGG	51.3	LT 0.2	LT 0.2	5.99	LT 0.2
CALCIUM	UGG	8000	20600	19700	40800	13700
CHROMIUM	UGG	17	7.94	5.46	16	7.68
COBALT	UGG	4.33 JP	3.54 JP	3.61 JP	6.7	3.34 JP
COPPER	UGG	449	6.71	4.04	99.2	7.23
IRON	UGG	11700	6740	5320	12500	6390
LEAD	UGG	984	6.01	4.5	325	7.98
MAGNESIUM	UGG	3990	3680	2310	7330	3190
MANGANESE	UGG	220	147	86.4	396	136
MERCURY	UGG	0.0643	LT 0.05	LT 0.05	LT 0.05	LT 0.05
NICKEL	UGG	12.3	4.44	6.94	12.3	5.43
POTASSIUM	UGG	2100	1860	1060	3840	1810
SELENIUM	UGG	LT 0.5	LT 0.5	LT 0.5	LT 0.5	LT 0.5
SILVER	UGG	1.52	LT 1	LT 1	LT 1	LT 1
SODIUM	UGG	97.4	101	87.9	159	89.9
THALLIUM	UGG	LT 1	LT 1	LT 1	LT 1	LT 1
VANADIUM	UGG	17.2	17.2	14.1	30.4	16.2
ZINC	UGG	734	23	17.7	268	23.3

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Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

		SB2111C		SB2112A		SB2112B		SB2112C		SB2113A	
Sample No:		SB2111C		SB2112A		SB2112B		SB2112C		SB2113A	
Date Sampled:		12/6/99		12/7/99		12/8/99		12/8/99		12/7/99	
Depth:		2 - 3 FT		0 - 0.5 FT		1 - 2 FT		2 - 3 FT		0 - 0.5 FT	
ANALYTE	UNITS		L V R		L V R		L V R		L V R		L V R
METALTOT											
ALUMINUM	UGG	3570		3860		3790		3210		14700	
ANTIMONY	UGG	LT 1		9.61		LT 1	UJ m	LT 1	UJ m	225	
ARSENIC	UGG	4.2		3.86		4.11		4.33		10.5	
BARIUM	UGG	46.6		195		59.3	J m	67.2	J m	3640	
BERYLLIUM	UGG	0.189 JP		0.202 JP		0.183 JP	U o	0.198 JP	U o	0.407 JP	
CADMIUM	UGG	LT 0.2		11.4		LT 0.2	UJ m	LT 0.2	UJ m	96.1	
CALCIUM	UGG	14600		36800		37500	J m	46200	J m	29300	
CHROMIUM	UGG	6.93		13.1		6.64	J m	4.85	J m	154	
COBALT	UGG	2.99 JP		2.59 JP		2.89 JP	J m	LT 5	J m	9.79	
COPPER	UGG	5.52		151		3.76		2.72		4020	
IRON	UGG	5340		5900		5100		4640		35700	
LEAD	UGG	8.18		447		3.89	J m	3.98	J m	10800	
MAGNESIUM	UGG	1490		4120		3570	J m	3500	J m	7480	
MANGANESE	UGG	84.8		150		90.9	J m	60.7	J m	472	
MERCURY	UGG	LT 0.05		LT 0.05		LT 0.05		LT 0.05		0.142	
NICKEL	UGG	5.38		8.11		3.62 JP	J m	1.97 JP	J m	54.9	
POTASSIUM	UGG	973		1100		978	J m	730	J m	2570	
SELENIUM	UGG	LT 0.5		LT 0.5		LT 0.5		LT 0.5		LT 0.5	
SILVER	UGG	LT 1		1.19		LT 1		LT 1		5.45	
SODIUM	UGG	82.9		83.2		118	UJ m	144	UJ m	122	
THALLIUM	UGG	LT 1		LT 1		LT 1	J d	LT 1	J d	2.01	
VANADIUM	UGG	15.7		9.27		13	J m	12.3	J m	16.2	
ZINC	UGG	21.3		257		14	J m	10.7	J m	4970	

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Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

ANALYTE	UNITS	SB2113B	L V R	SB2113C	L V R	SB2114A	L V R	SB2114B	L V R	SB2115A	L V R
Sample No:		SB2113B		SB2113C		SB2114A		SB2114B		SB2115A	
Date Sampled:		12/8/99		12/8/99		12/7/99		12/7/99		12/7/99	
Depth:		1 - 2 FT		2 - 3 FT		0 - 0.5 FT		1 - 2 FT		0 - 0.5 FT	
METALTOT											
ALUMINUM	UGG	8870		3440		5700		14400		7340	
ANTIMONY	UGG	2.82	J m	LT 1	UJ m	6.22		1.64		55.5	
ARSENIC	UGG	4.78		3.2		5.71		10.8		5.71	
BARIUM	UGG	102	J m	55.7	J m	122		161		164	
BERYLLIUM	UGG	0.408	JP	0.184	JP U o	0.258	JP	0.631		0.275	JP
CADMIUM	UGG	0.332	UJ m	LT 0.2	UJ m	3.11		0.581		4.64	
CALCIUM	UGG	26100	J m	30600	J m	33300		31500		37200	
CHROMIUM	UGG	10.1	J m	4.86	J m	12.2		17.3		13.3	
COBALT	UGG	5.61	J m	2.47	JP J m	3.13	JP	6.12		4.73	JP
COPPER	UGG	9.38		3.58		101		15.2		182	
IRON	UGG	8790		4650		5600		12500		7620	
LEAD	UGG	9.42	J m	3.56	J m	236		23.9		273	
MAGNESIUM	UGG	5540	J m	3370	J m	8880		9000		6350	
MANGANESE	UGG	214	J m	70.6	J m	152		401		195	
MERCURY	UGG	LT 0.05		LT 0.05		LT 0.05		LT 0.05		LT 0.05	
NICKEL	UGG	8.08	J m	4.43	J m	14.4		11.1		9.52	
POTASSIUM	UGG	2960	J m	879	J m	1910		4760		1960	
SELENIUM	UGG	LT 0.5		LT 0.5		LT 0.5		LT 0.5		LT 0.5	
SILVER	UGG	LT 1		0.907	JP	0.881	JP	1	JP	LT 1	
SODIUM	UGG	149	UJ m	144	UJ m	348		299		117	
THALLIUM	UGG	LT 1	J d	LT 1		LT 1		LT 1		LT 1	
VANADIUM	UGG	20.1	J m	12.3	J m	14.6		29.2		17	
ZINC	UGG	31.9	J m	13.8	J m	221		60.6		273	

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Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

		SB2117A	SB2117C	SB2117D	SS2115	SS2116
Sample No:		SB2117A	SB2117C	SB2117D	SS2115	SS2116
Date Sampled:		12/7/99	12/8/99	12/8/99	12/6/99	12/6/99
Depth:		0 - 0.5 FT	2 - 3 FT	4 - 5 FT	0 - 0.5 FT	0 - 0.5 FT
ANALYTE	UNITS	L V R	L V R	L V R	L V R	L V R
METALTOT						
ALUMINUM	UGG	6270	4630	4500	12700	13500
ANTIMONY	UGG	9.63	LT 1 UJ m	LT 1 UJ m	2.1	59.3
ARSENIC	UGG	5.87	3.34	3.84	6.19	9.21
BARIUM	UGG	336	59 J m	56.6 J m	142	2210
BERYLLIUM	UGG	0.305 JP	0.236 JP U o	0.244 JP U o	0.569 JP	0.518 JP
CADMIUM	UGG	7.33	LT 0.2 UJ m	LT 0.2 UJ m	0.711	39.1
CALCIUM	UGG	28600	32700 J m	32700 J m	13800	21500
CHROMIUM	UGG	22.2	7.02 J m	7.86 J m	14.4	48
COBALT	UGG	2.71 JP	2.25 JP J m	3.51 JP J m	7.05	7.6
COPPER	UGG	128	4.74	3.41	22.4	1810
IRON	UGG	6550	5770	5680	11200	13400
LEAD	UGG	620	4.5 J m	4.05 J m	59	4600
MAGNESIUM	UGG	6150	3710 J m	4230 J m	5920	7370
MANGANESE	UGG	229	100 J m	81.8 J m	336	369
MERCURY	UGG	0.243	LT 0.05	LT 0.05	LT 0.05	LT 0.05
NICKEL	UGG	8.86	6.59 J m	2.21 JP J m	10.4	29.6
POTASSIUM	UGG	2170	1250 J m	1070 J m	4050	3630
SELENIUM	UGG	LT 0.5	LT 0.5	LT 0.5	LT 0.5	LT 0.5
SILVER	UGG	0.941 JP	LT 1	LT 1	LT 1	4.48
SODIUM	UGG	103	135 UJ m	163 UJ m	207	179
THALLIUM	UGG	LT 1	LT 1	LT 1 J d	LT 1	LT 1
VANADIUM	UGG	12.7	14.9 J m	16 J m	31.1	24.8
ZINC	UGG	394	17.1 J m	14.1 J m	62.2	2270

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Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

ANALYTE	UNITS	SS2117 12/6/99 0 - 0.5 FT	L V R	SS2118 12/6/99 0 - 0.5 FT	L V R	SS2119 12/6/99 0 - 0.5 FT	L V R	SS2120 12/6/99 0 - 0.5 FT	L V R	SS2121 12/6/99 0 - 0.5 FT	L V R
METALTOT											
ALUMINUM	UGG	6130		7350		9400		5250		7330	
ANTIMONY	UGG	33.4		25.9		48.1		12.5		1.79	
ARSENIC	UGG	5.26		4.35		6.29		8.54		4.66	
BARIUM	UGG	999		235		809		131		139	
BERYLLIUM	UGG	0.55		0.366	JP	0.354	JP	0.276	JP	0.362	JP
CADMIUM	UGG	33.5		14		30.2		5.16		1.63	
CALCIUM	UGG	40200		29000		22100		34400		23100	
CHROMIUM	UGG	23.3		12.9		37		11.8		9.19	
COBALT	UGG	4.24	JP	5.06	JP	4.95	JP	4.04	JP	4.98	JP
COPPER	UGG	529		151		1190		233		121	
IRON	UGG	7470		8130		15700		6250		7670	
LEAD	UGG	1710		938		2340		861		67.4	
MAGNESIUM	UGG	4260		5120		5200		5090		3940	
MANGANESE	UGG	166		195		266		172		208	
MERCURY	UGG	LT 0.05		LT 0.05		LT 0.05		LT 0.05		LT 0.05	
NICKEL	UGG	16.9		12.7		19.5		7.43		8.41	
POTASSIUM	UGG	1520		2340		2560		1880		2300	
SELENIUM	UGG	LT 0.5		LT 0.5		LT 0.5		LT 0.5		LT 0.5	
SILVER	UGG	0.886	JP	1.14		3.49		LT 1		LT 1	
SODIUM	UGG	96.3		130		124		218		118	
THALLIUM	UGG	LT 1		LT 1		LT 1		LT 1		LT 1	
VANADIUM	UGG	13.5		19.8		17.3		15.2		20.1	
ZINC	UGG	1020		308		4160		208		111	

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Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

Sample No: SS2122
Date Sampled: 12/6/99
Depth: 0 - 0.5 FT

ANALYTE	UNITS	L		V	R
METALTOT					
ALUMINUM	UGG		7010		
ANTIMONY	UGG		5.63		
ARSENIC	UGG		4.51		
BARIUM	UGG		394		
BERYLLIUM	UGG		0.336	JP	
CADMIUM	UGG		12.3		
CALCIUM	UGG		29600		
CHROMIUM	UGG		13		
COBALT	UGG		3.85	JP	
COPPER	UGG		305		
IRON	UGG		7260		
LEAD	UGG		468		
MAGNESIUM	UGG		4900		
MANGANESE	UGG		219		
MERCURY	UGG	LT	0.05		
NICKEL	UGG		11		
POTASSIUM	UGG		2100		
SELENIUM	UGG	LT	0.5		
SILVER	UGG	LT	1		
SODIUM	UGG		113		
THALLIUM	UGG	LT	1		
VANADIUM	UGG		17.3		
ZINC	UGG		417		

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Data Summary Report For: SWMU 21
Chemical Analysis Data
SOIL

Sample No:		SB2117A				SB2117C				SB2117D			
Date Sampled:		12/7/99				12/8/99				12/8/99			
Depth:		0 - 0.5 FT				2 - 3 FT				4 - 5 FT			
ANALYTE	UNITS		L	V	R		L	V	R		L	V	R
EXP													
1,3,5-TRINITROBENZENE	UGG	LT	0.1	U		LT	0.1	U		LT	0.1	U	
1,3-DINITROBENZENE	UGG	LT	0.1	U		LT	0.1	U		LT	0.1	U	
2,4,6-TRINITROTOLUENE	UGG	LT	0.2	U		LT	0.2	U		LT	0.2	U	
2,4-DINITROTOLUENE	UGG	LT	0.2	U		LT	0.2	U		LT	0.2	U	
2,6-DINITROTOLUENE	UGG	LT	0.2	U		LT	0.2	U		LT	0.2	U	
2-AMINO-4,6-DINITROTOLUENE	UGG	LT	0.2	U		LT	0.2	U		LT	0.2	U	
2-NITROTOLUENE	UGG	LT	0.4	U		LT	0.4	U		LT	0.4	U	
3-NITROTOLUENE	UGG	LT	0.4	U		LT	0.4	U		LT	0.4	U	
4-AMINO-2,6-DINITROTOLUENE	UGG	LT	0.2	U		LT	0.2	U		LT	0.2	U	
4-NITROTOLUENE	UGG	LT	0.4	U		LT	0.4	U		LT	0.4	U	
HMX	UGG	LT	0.2	U		LT	0.2	U		LT	0.2	U	
NITROBENZENE	UGG	LT	0.2	U		LT	0.2	U		LT	0.2	U	
RDX	UGG	LT	0.2	U		LT	0.2	U		LT	0.2	U	
TETRYL	UGG	LT	0.2	U		LT	0.2	U		LT	0.2	U	

Chemical Data – QA/QC

Field Blanks

Equipment Rinse Blanks

Trip Blanks

CMS
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D-121

Data Summary Report For: Tooele North
Chemical Analysis Data
FIELD BLANKS

Sample No:		DW120699	SW120699
Date Sampled:		12/6/99	12/6/99
Depth:		0 - 0 FT	0 - 0 FT

ANALYTE	UNITS			L V R			L V R
VOC							
1,1,1-TRICHLOROETHANE	UGL	LT	5		LT	5	
1,1,2,2-TETRACHLOROETHANE	UGL	LT	5		LT	5	
1,1,2-TRICHLOROETHANE	UGL	LT	5		LT	5	
1,1-DICHLOROETHANE	UGL	LT	5		LT	5	
1,1-DICHLOROETHENE	UGL	LT	5		LT	5	
1,2-DICHLOROETHANE	UGL	LT	5		LT	5	
1,2-DICHLOROETHENE	UGL	LT	10		LT	10	
1,2-DICHLOROPROPANE	UGL	LT	5		LT	5	
ACETONE	UGL		8.5	J r	LT	5	UJ r
BENZENE	UGL	LT	5		LT	5	
BROMODICHLOROMETHANE	UGL	LT	5		LT	5	
BROMOFORM	UGL	LT	5		LT	5	
BROMOMETHANE	UGL	LT	5		LT	5	
CARBON DISULFIDE	UGL	LT	5		LT	5	
CARBON TETRACHLORIDE	UGL	LT	5		LT	5	
CHLOROBENZENE	UGL	LT	5		LT	5	
CHLOROETHANE	UGL	LT	5		LT	5	
CHLOROFORM	UGL	LT	5		LT	5	
CHLOROMETHANE	UGL	LT	5		LT	5	
CIS-1,3-DICHLOROPROPENE	UGL	LT	5		LT	5	
DIBROMOCHLOROMETHANE	UGL	LT	5		LT	5	
ETHYLBENZENE	UGL	LT	5		LT	5	
METHYL-N-BUTYL KETONE	UGL	LT	5		LT	5	
METHYLENE CHLORIDE	UGL	LT	5		LT	5	
METHYLETHYL KETONE	UGL	LT	5	R c	LT	5	R c
METHYLISOBUTYL KETONE	UGL	LT	5		LT	5	
STYRENE	UGL	LT	5		LT	5	
TETRACHLOROETHYLENE	UGL	LT	5		LT	5	
TOLUENE	UGL	LT	5		LT	5	
TRANS-1,3-DICHLOROPROPENE	UGL	LT	5		LT	5	
TRICHLOROETHYLENE	UGL	LT	5		LT	5	
VINYL CHLORIDE	UGL	LT	5		LT	5	
XYLENE (TOTAL)	UGL	LT	15		LT	15	

Data Summary Report For: Tooele North
Chemical Analysis Data
FIELD BLANKS

ANALYTE	UNITS	Sample No: DW120699 Date Sampled: 12/6/99 Depth: 0 - 0 FT	L V R	Sample No: SW120699 Date Sampled: 12/6/99 Depth: 0 - 0 FT	L V R
EXP					
1,3,5-TRINITROBENZENE	UGL	LT 0.65		LT 0.65	
1,3-DINITROBENZENE	UGL	LT 0.65		LT 0.65	
2,4,6-TRINITROTOLUENE	UGL	LT 0.26		LT 0.26	
2,4-DINITROTOLUENE	UGL	LT 0.65		LT 0.65	
2,6-DINITROTOLUENE	UGL	LT 0.26		LT 0.26	
2-AMINO-4,6-DINITROTOLUENE	UGL	LT 0.26		LT 0.26	
2-NITROTOLUENE	UGL	LT 0.52		LT 0.52	
3-NITROTOLUENE	UGL	LT 0.52		LT 0.52	
4-AMINO-2,6-DINITROTOLUENE	UGL	LT 0.26		LT 0.26	
4-NITROTOLUENE	UGL	LT 0.52		LT 0.52	
HMX	UGL	LT 0.26		LT 0.26	
NITROBENZENE	UGL	LT 0.26		LT 0.26	
RDX	UGL	LT 0.26		LT 0.26	
TETRYL	UGL	LT 0.26		LT 0.26	

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Data Summary Report For: Tooele North
Chemical Analysis Data
FIELD BLANKS

Sample No:		DW120699	SW120699
Date Sampled:		12/6/99	12/6/99
Depth:		0 - 0 FT	0 - 0 FT

ANALYTE	UNITS	L	DW120699	V	R	L	SW120699	V	R
METALTOT									
ALUMINUM	UGL	LT	200			LT	200		
ANTIMONY	UGL		2.95	JP U	o		3.25	JP U	o
ARSENIC	UGL	LT	5			LT	5		
BARIUM	UGL	LT	20	UJ	c		50.6		
BERYLLIUM	UGL	LT	5			LT	5		
CADMIUM	UGL	LT	2			LT	2		
CALCIUM	UGL		60.6	JP U	p		86100		
CHROMIUM	UGL	LT	10			LT	10		
COBALT	UGL	LT	50			LT	50		
COPPER	UGL	LT	20				8.26	JP	
IRON	UGL	LT	50				52.8		
LEAD	UGL	LT	3			LT	3		
MAGNESIUM	UGL	LT	100				32700		
MANGANESE	UGL	LT	10	UJ	c	LT	10	UJ	c
MERCURY	UGL	LT	0.1			LT	0.1		
NICKEL	UGL	LT	40			LT	40		
POTASSIUM	UGL	LT	3000				3190		
SELENIUM	UGL	LT	5			LT	5		
SILVER	UGL	LT	10			LT	10		
SODIUM	UGL		139	JP U	p		98500		
THALLIUM	UGL	LT	10			LT	10		
VANADIUM	UGL	LT	50			LT	50		
ZINC	UGL	LT	20				24.2		

CMS
A-TEAD
D-123

Data Summary Report For: Tooele North
Chemical Analysis Data
EQUIPMENT BLANKS

Sample No: SB2029CB | SB2117AB
Date Sampled: 12/9/99 | 12/7/99
Depth: 0 - 0 FT | 0 - 0 FT

ANALYTE	UNITS	SB2029CB	L V R	SB2117AB	L V R
EXP					
1,3,5-TRINITROBENZENE	UGL	LT 0.65		LT 0.65	
1,3-DINITROBENZENE	UGL	LT 0.65		LT 0.65	
2,4,6-TRINITROTOLUENE	UGL	LT 0.26		LT 0.26	
2,4-DINITROTOLUENE	UGL	LT 0.65		LT 0.65	
2,6-DINITROTOLUENE	UGL	LT 0.26		LT 0.26	
2-AMINO-4,6-DINITROTOLUENE	UGL	LT 0.26		LT 0.26	
2-NITROTOLUENE	UGL	LT 0.52		LT 0.52	
3-NITROTOLUENE	UGL	LT 0.52		LT 0.52	
4-AMINO-2,6-DINITROTOLUENE	UGL	LT 0.26		LT 0.26	
4-NITROTOLUENE	UGL	LT 0.52		LT 0.52	
HMX	UGL	LT 0.26		LT 0.26	
NITROBENZENE	UGL	LT 0.26		LT 0.26	
RDX	UGL	LT 0.26		LT 0.26	
TETRYL	UGL	LT 0.26		LT 0.26	

CMS
A-TEAD
D-124

Data Summary Report For: Tooele North
Chemical Analysis Data
EQUIPMENT BLANKS

ANALYTE	UNITS	SB0216CB	SB0217CB	SB0219CB	SB2021CB	SB2029CB
Date Sampled:		12/13/99	12/12/99	12/14/99	12/9/99	12/9/99
Depth:		0 - 0 FT	0 - 0 FT	0 - 0 FT	0 - 0 FT	0 - 0 FT
		L V R	L V R	L V R	L V R	L V R
METALTOT						
ALUMINUM	UGL	LT 200	98.9 JP	LT 200	NT	LT 200
ANTIMONY	UGL	LT 5	LT 5	LT 5	LT 10	LT 5
ARSENIC	UGL	LT 5	LT 5	LT 5	NT	LT 5
BARIUM	UGL	LT 20	LT 20	LT 20	NT	LT 20
BERYLLIUM	UGL	LT 5	LT 5	LT 5	NT	LT 5
CADMIUM	UGL	LT 2	LT 2	LT 2	NT	LT 2
CALCIUM	UGL	84.7 JP	678	74.8 JP	NT	74.5 JP
CHROMIUM	UGL	LT 10	LT 10	LT 10	NT	LT 10
COBALT	UGL	LT 50	LT 50	LT 50	NT	LT 50
COPPER	UGL	LT 20	LT 20	LT 20	NT	LT 20
IRON	UGL	LT 50	88.5	LT 50	NT	LT 50
LEAD	UGL	LT 3	LT 3	LT 3	LT 6	LT 3
MAGNESIUM	UGL	LT 100	121	LT 100	NT	LT 100
MANGANESE	UGL	LT 10	LT 10	LT 10	NT	LT 10
MERCURY	UGL	LT 0.1	LT 0.1	LT 0.1	NT	LT 0.1
NICKEL	UGL	LT 40	LT 40	LT 40	NT	LT 40
POTASSIUM	UGL	LT 3000	LT 3000	LT 3000	NT	LT 3000
SELENIUM	UGL	LT 5	LT 5	LT 5	NT	LT 5
SILVER	UGL	LT 10	LT 10	LT 10	NT	LT 10
SODIUM	UGL	181 JP	349	212	NT	208
THALLIUM	UGL	LT 10	LT 10	LT 10	NT	LT 10
VANADIUM	UGL	LT 50	LT 50	LT 50	NT	LT 50
ZINC	UGL	LT 20	LT 20	LT 20	NT	LT 20

CMS
A-TEAD
D-125

Data Summary Report For: Tooele North
Chemical Analysis Data
EQUIPMENT BLANKS

Sample No:		SB2105AB		SB2117AB		SB2303DB		SS2118B	
Date Sampled:		12/7/99		12/7/99		12/11/99		12/6/99	
Depth:		0 - 0 FT		0 - 0 FT		0 - 0 FT		0 - 0 FT	
ANALYTE	UNITS		L V R		L V R		L V R		L V R
METALTOT									
ALUMINUM	UGL	LT	200	LT	200		NT	LT	200
ANTIMONY	UGL		2.42 JP	LT	10	LT	20		2.96 JP
ARSENIC	UGL	LT	5	LT	5		NT	LT	5
BARIUM	UGL	LT	20	LT	20		NT	LT	20
BERYLLIUM	UGL	LT	5	LT	5		NT	LT	5
CADMIUM	UGL	LT	2	LT	2		NT	LT	2
CALCIUM	UGL		45.4 JP		48.6 JP		NT		39.8 JP
CHROMIUM	UGL	LT	10	LT	10		NT	LT	10
COBALT	UGL	LT	50	LT	50		NT	LT	50
COPPER	UGL	LT	20	LT	20		NT	LT	20
IRON	UGL	LT	50	LT	50		NT	LT	50
LEAD	UGL	LT	3	LT	3	LT	3	LT	3
MAGNESIUM	UGL	LT	100	LT	100		NT	LT	100
MANGANESE	UGL	LT	10	LT	10		NT	LT	10
MERCURY	UGL	LT	0.1	LT	0.1		NT	LT	0.1
NICKEL	UGL	LT	40	LT	40		NT	LT	40
POTASSIUM	UGL	LT	3000	LT	3000		NT	LT	3000
SELENIUM	UGL	LT	5	LT	5		NT	LT	5
SILVER	UGL	LT	10	LT	10		NT	LT	10
SODIUM	UGL		165 JP		159 JP		NT	LT	200
THALLIUM	UGL	LT	10	LT	10		NT	LT	10
VANADIUM	UGL	LT	50	LT	50		NT	LT	50
ZINC	UGL	LT	20	LT	20		NT	LT	20

CMS
A-TEAD
D-126

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A-TEAD
D-127

Data Summary Report For: Tooele North
Chemical Analysis Data
EQUIPMENT BLANKS

	Sample No:	SB0216CB	SB0217CB	SB0219CB	SB2303DB
	Date Sampled:	12/13/99	12/12/99	12/14/99	12/11/99
	Depth:	0 - 0 FT	0 - 0 FT	0 - 0 FT	0 - 0 FT
ANALYTE	UNITS	L V R	L V R	L V R	L V R
VOC					
1,1,1-TRICHLOROETHANE	UGL	LT 5	LT 5	LT 5	LT 5
1,1,2,2-TETRACHLOROETHANE	UGL	LT 5	LT 5	LT 5	LT 5
1,1,2-TRICHLOROETHANE	UGL	LT 5	LT 5	LT 5	LT 5
1,1-DICHLOROETHANE	UGL	LT 5	LT 5	LT 5	LT 5
1,1-DICHLOROETHENE	UGL	LT 5	LT 5	LT 5	LT 5
1,2-DICHLOROETHANE	UGL	LT 5	LT 5	LT 5	LT 5
1,2-DICHLOROETHENE	UGL	LT 10	LT 10	LT 10	LT 10
1,2-DICHLOROPROPANE	UGL	LT 5	LT 5	LT 5	LT 5
ACETONE	UGL	8.6	10	6.2	4.2 JP
BENZENE	UGL	LT 5	LT 5	LT 5	LT 5
BROMODICHLOROMETHANE	UGL	LT 5	LT 5	LT 5	LT 5
BROMOFORM	UGL	LT 5	LT 5	LT 5	LT 5
BROMOMETHANE	UGL	LT 5	LT 5	LT 5	LT 5
CARBON DISULFIDE	UGL	LT 5	6.8	LT 5	LT 5
CARBON TETRACHLORIDE	UGL	LT 5	LT 5	LT 5	LT 5
CHLOROBENZENE	UGL	LT 5	LT 5	LT 5	LT 5
CHLOROETHANE	UGL	LT 5	LT 5	LT 5	LT 5
CHLOROFORM	UGL	LT 5	LT 5	LT 5	LT 5
CHLOROMETHANE	UGL	LT 5	LT 5	LT 5	LT 5
CIS-1,3-DICHLOROPROPENE	UGL	LT 5	LT 5	LT 5	LT 5
DIBROMOCHLOROMETHANE	UGL	LT 5	LT 5	LT 5	LT 5
ETHYLBENZENE	UGL	LT 5	LT 5	LT 5	LT 5
METHYL-N-BUTYL KETONE	UGL	LT 5	LT 5	LT 5	LT 5
METHYLENE CHLORIDE	UGL	LT 5	LT 5	LT 5	LT 5
METHYLETHYL KETONE	UGL	LT 5	LT 5	LT 5	LT 5
METHYLISOBUTYL KETONE	UGL	LT 5	LT 5	LT 5	LT 5
STYRENE	UGL	LT 5	LT 5	LT 5	LT 5
TETRACHLOROETHYLENE	UGL	LT 5	LT 5	LT 5	LT 5
TOLUENE	UGL	0.51 JP	0.44 JP	0.49 JP	0.41 JP
TRANS-1,3-DICHLOROPROPENE	UGL	LT 5	LT 5	LT 5	LT 5
TRICHLOROETHYLENE	UGL	LT 5	LT 5	LT 5	LT 5
VINYL CHLORIDE	UGL	LT 5	LT 5	LT 5	LT 5
XYLENE (TOTAL)	UGL	LT 15	LT 15	LT 15	LT 15

CMS
A-TEAD
D-128

Data Summary Report For: Tooele North
Chemical Analysis Data
TRIP BLANKS

Sample No:		TB120699		TB120999		TB121199		TB121299		TB121399	
Date Sampled:		12/6/99		12/9/99		12/11/99		12/12/99		12/13/99	
Depth:		0 - 0 FT		0 - 0 FT		0 - 0 FT		0 - 0 FT		0 - 0 FT	
ANALYTE	UNITS		L V R		L V R		L V R		L V R		L V R
VOC											
1,1,1-TRICHLOROETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
1,1,2,2-TETRACHLOROETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
1,1,2-TRICHLOROETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
1,1-DICHLOROETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
1,1-DICHLOROETHENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
1,2-DICHLOROETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
1,2-DICHLOROETHENE	UGL	LT	10	LT	10	LT	10	LT	10	LT	10
1,2-DICHLOROPROPANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
ACETONE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
BENZENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
BROMODICHLOROMETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
BROMOFORM	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
BROMOMETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
CARBON DISULFIDE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
CARBON TETRACHLORIDE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
CHLOROBENZENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
CHLOROETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
CHLOROFORM	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
CHLOROMETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
CIS-1,3-DICHLOROPROPENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
DIBROMOCHLOROMETHANE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
ETHYLBENZENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
METHYL-N-BUTYL KETONE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
METHYLENE CHLORIDE	UGL		2.2 JP	LT	5		2.6 JP		2.4 JP		0.35 JP
METHYLETHYL KETONE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
METHYLISOBUTYL KETONE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
STYRENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
TETRACHLOROETHYLENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
TOLUENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
TRANS-1,3-DICHLOROPROPENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
TRICHLOROETHYLENE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
VINYL CHLORIDE	UGL	LT	5	LT	5	LT	5	LT	5	LT	5
XYLENE (TOTAL)	UGL	LT	15	LT	15	LT	15	LT	15	LT	15

CMS
A-TEAD
D-129

Data Summary Report For: Tooele North
Chemical Analysis Data
TRIP BLANKS

Sample No: TB121499
Date Sampled: 12/14/99
Depth: 0 - 0 FT

ANALYTE	UNITS	L V R	
VOC			
1,1,1-TRICHLOROETHANE	UGL	LT	5
1,1,2,2-TETRACHLOROETHANE	UGL	LT	5
1,1,2-TRICHLOROETHANE	UGL	LT	5
1,1-DICHLOROETHANE	UGL	LT	5
1,1-DICHLOROETHENE	UGL	LT	5
1,2-DICHLOROETHANE	UGL	LT	5
1,2-DICHLOROETHENE	UGL	LT	10
1,2-DICHLOROPROPANE	UGL	LT	5
ACETONE	UGL		5.9
BENZENE	UGL	LT	5
BROMODICHLOROMETHANE	UGL	LT	5
BROMOFORM	UGL	LT	5
BROMOMETHANE	UGL	LT	5
CARBON DISULFIDE	UGL	LT	5
CARBON TETRACHLORIDE	UGL	LT	5
CHLOROBENZENE	UGL	LT	5
CHLOROETHANE	UGL	LT	5
CHLOROFORM	UGL	LT	5
CHLOROMETHANE	UGL	LT	5
CIS-1,3-DICHLOROPROPENE	UGL	LT	5
DIBROMOCHLOROMETHANE	UGL	LT	5
ETHYLBENZENE	UGL	LT	5
METHYL-N-BUTYL KETONE	UGL	LT	5
METHYLENE CHLORIDE	UGL		1.9 JP
METHYLETHYL KETONE	UGL	LT	5
METHYLISOBUTYL KETONE	UGL	LT	5
STYRENE	UGL	LT	5
TETRACHLOROETHYLENE	UGL	LT	5
TOLUENE	UGL	LT	5
TRANS-1,3-DICHLOROPROPENE	UGL	LT	5
TRICHLOROETHYLENE	UGL	LT	5
VINYL CHLORIDE	UGL	LT	5
XYLENE (TOTAL)	UGL	LT	15

ATTACHMENT D

Data Quality Assessment

SWMU 20 Data Validation Report – Soil

DATA VALIDATION REPORT - Level IV Review

Lot No.: BRDQ

Fraction: Antimony

Lab: DataChem

Project Name: Tooele, North

Reviewer: JFK

Date: May 3, 2000

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied (as required), supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the Region III Modifications to the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: The matrix spikes displayed recoveries less than the lower QC limit, indicating more than usual (negative) bias in the results. The laboratory duplicate also displayed RPDs greater than the QC limit. All antimony results were flagged "J/UJ".

Correctable Anomalies: None.

Comments: None.

Signed: E.Z. for John Harris

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a .Reason Code.. The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

DATA VALIDATION REPORT - Level IV Review

Lot No.: ____BRRB________ **Fraction:** ______Lead___________

Lab: ____DataChem________ **Project Name:** __Tooele, North___

Reviewer: ____JFK_________ **Date:** _____May 3, 2000_________

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied (as required), supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the Region III Modifications to the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: The matrix spikes displayed recoveries less than the lower QC limit, indicating more than usual (negative) bias in the results. All lead results were flagged "J/UJ".

Correctable Anomalies: None.

Comments: None.

Signed: E. Z. for J. Kearns

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a .Reason Code.. The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

SWMU 21 Data Validation Reports – Soil

DATA VALIDATION REPORT - Level IV Review

Lot No.:_____BRQQ________ **Fraction:___Metals____________**

Lab:__DataChem__________ **Project Name:__Tooelle, North__**

Reviewer:____JFK__________ **Date:_____May 22, 2000________**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: Barium, calium, chromium, cobalt, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc results were flagged "J/UJ" due to matrix spike failures. Trace level sodium and beryllium results were flagged "U" due to blank contamination.

Correctable Anomalies: None.

Comments: None.

Signed: EZ for J.Kearns

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a "Reason Code". The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

DATA VALIDATION REPORT - Level IV Review

Lot No.:_____BRGM________ **Fraction:___Mercury__________**

Lab:__DataChem__________ **Project Name:__Tooelle, North__**

Reviewer:____JFK__________ **Date:_____May 22, 2000________**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: None.

Correctable Anomalies: None.

Comments: None.

Signed: E. Z for J. Keens

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a "Reason Code". The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

DATA VALIDATION REPORT - Level IV Review

Lot No.:_____BRQR________

Fraction:_Trace Metals__________

Lab:__DataChem_________

Project Name:__Tooelle, North__

Reviewer:____JFK__________

Date:_____May 30, 2000________

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: Matrix spike failures resulted in the application of "J" flags on cadmium and lead data. Thallium positive detections were flagged "J" due to duplicate failures. Some cadmium results mwere also flagged "U" due to blank contamination.

Correctable Anomalies: None.

Comments: None.

Signed:____E. T. for J. Kearns____

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a "Reason Code". The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a “Reason Code”. The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

DATA VALIDATION REPORT - Level IV Review

Lot No.:_____BRJC________

Fraction:_____Explosives______

Lab:____DataChem_______

Project Name:__Tooele, North___

Reviewer:____JFK________

Date:_____May 3, 2000________

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied (as required), supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the Region III Modifications to the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: None.

Correctable Anomalies: None.

Comments: None.

Signed: E.Z for J.Kerrs

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a .Reason Code.. The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

SWMU 23 Data Validation Report – Soil

DATA VALIDATION REPORT - Level IV Review

Lot No.:_____BRPY________ **Fraction:_____VOCs___________**

Lab:____DataChem________ **Project Name:__Tooele, North___**

Reviewer:____JFK_________ **Date:_____May 3, 2000_________**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied (as required), supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the Region III Modifications to the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: Acetone, 2-butanone, and 2-hexanone displayed %RSDs in the initial calibration greater than the QC limit. These results were flagged "J/UJ" in the associated samples. Trip blanks displayed trace level contamination with methylene chloride. Positive results less than 10X the value in the trip blank were flagged "U".

Correctable Anomalies: None.

Comments: None.

Signed: E.K. for J.Kems

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a .Reason Code.. The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

QA/QC Water Data Validation Report

CMS
A-TEAD
D-165

DATA VALIDATION REPORT - Level IV Review

Lot No.: BRMX

Fraction: ICP Metals

Lab: DataChem

Project Name: Tooele, North

Reviewer: JFK

Date: May 3, 2000

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied (as required), supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the Region III Modifications to the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: Trace level concentrations of calcium and silver were observed in the preparation blank. Positive calcium results less than 5X the concentration in the blank were flagged "U" in affected samples. The calibration blanks displayed trace level contamination with antimony, beryllium, copper, silver, and sodium. Positive results less than 5X the concentration in the blank were flagged "U". Silver displayed non-detects for all samples and no data flags were required. Barium and manganese displayed CRDL standard recoveries greater than the upper control limit. Non-detects and positive results less than two times the reporting limit were flagged "J/UJ".

Correctable Anomalies: None.

Comments: The laboratory flagged various analytes as failing to meet duplicate precision criteria. However, these data do meet the criteria established in the USEPA National Functional guidelines and no data qualification was required. The ICS A displayed positive and negative detections for non-spiked analytes. However, none of the field samples displayed similar levels of interferents and no data qualification was required.

Signed: E. L. for J. Kraus

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a .Reason Code.. The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

DATA VALIDATION REPORT - Level IV Review

Lot No.:____BRMY________

Fraction:_ICP Metals (Trace)_____

Lab:____DataChem________

Project Name:__Tooele, North___

Reviewer:____JFK_________

Date:____May 30, 2000_________

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied (as required), supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the Region III Modifications to the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: Trace level concentrations of lead and cadmium were observed in the preparation blank. Positive lead results were flagged "B" in all affected samples. Cadmium displayed non-detects for all samples and no data flags were required.

Correctable Anomalies: None.

Comments: Lead displayed serial dilution and ICS anomalies. However, the sample results were already flagged "B" based on blank contamination and no further action was required.

Signed:_____E.Z. for J. Kramer_____

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a .Reason Code.. The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

DATA VALIDATION REPORT - Level IV Review

Lot No.:_____BRHD_______ Fraction:______ Mercury_______

Lab:____DataChem________ Project Name:__Tooele, North___

Reviewer:____JFK_________ Date:_____May 3, 2000_________

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied (as required), supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the Region III Modifications to the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: None.

Correctable Anomalies: None.

Comments: None.

Signed: E. Z. for J. Kleas

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a .Reason Code.. The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

DATA VALIDATION REPORT - Level IV Review

Lot No.:_____BRXB________ **Fraction:___Antimony_________**

Lab:__DataChem__________ **Project Name:__Tooelle, North__**

Reviewer:____JFK__________ **Date:_____May 22, 2000________**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: All samples were flagged "U" due to blank contamination.

Correctable Anomalies: None.

Comments: None.

Signed: E. T. for John Kerns

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a "Reason Code". The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

DATA VALIDATION REPORT - Level IV Review

Lot No.:_____BRMM______ **Fraction:_____VOCs__________**

Lab:____DataChem_______ **Project Name:__Tooele, North___**

Reviewer:____JFK_________ **Date:_____May 3, 2000_________**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied (as required), supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the Region III Modifications to the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: 2-Butanone displayed an RRF in the initial calibration less than the QC limit. Associated results were flagged "R".

Minor Anomalies: Acetone displayed a %RSD in the initial calibration greater than the QC limit. Acetone results were flagged "J/UJ" in the associated samples.

Correctable Anomalies: None.

Comments: Trip blanks displayed trace level contamination with methylene chloride. However, none of the samples in this lot displayed methylene chloride detections and no data flags were applied.

Signed:_____E.Z. for John Hesters_____

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

CMS
A-TEAD
D-181

Another type of code used by Dames & Moore is a .Reason Code.. The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

DATA VALIDATION REPORT - Level IV Review

Lot No.:_____BRDK_______ **Fraction:___Explosives_________**

Lab:__DataChem_________ **Project Name:__Tooelle, North__**

Reviewer:____JFK_________ **Date:_____May 22, 2000________**

This report presents the findings of a review of the referenced data. The report consists of this summary, a listing of the samples included in the review, copies of data reports with data qualifying flags applied, supporting documentation, and an explanation of the data qualifying flags employed. The review performed is based on the USEPA National Functional Guidelines for Data Review, modified to reflect the level of review requested, the specifics of the analytical method employed, and provisions of the approved project-specific QAPP.

Major Anomalies: None.

Minor Anomalies: None.

Correctable Anomalies: None.

Comments: None.

Signed: EZ for J.Kerns

Data Qualifying Codes

Two types of data qualifying codes or flags are applied in the course of the data review. The data validation flags indicate data that are not usable for decision making, more than normally biased and/or variable, or not representative of field conditions. These codes and their definitions are presented below in the hierarchy stipulated in the USEPA National Functional Guidelines for Data Review.

Data Validation Flags

Flag	Interpretation
R	The datum is unusable due to serious quality control failures.
U	The datum should be considered a non-detect at the value reported due to blank contamination.
J	The datum should be considered an estimated value, more highly biased or variable than normal.
UJ	The datum should be considered a non-detect, however, the detection limit may be inaccurate.
X	The datum is effected by a special circumstance explained at the bottom of the data report.

Another type of code used by Dames & Moore is a "Reason Code". The reason code indicates the type of quality control failure that lead to the application of the data validation flag.

Reason Codes

GC/MS Organics		GC and HPLC Organics		Inorganics and Conventionals	
Code	Interpretation	Code	Interpretation	Code	Interpretation
a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence	a	Incorrect or incomplete analytical sequence
c	Calibration failure; poor or unstable response	b	Instrument performance failure	c	Calibration failure
d	MS/MSD imprecision	c	Calibration failure; poor or unstable response	d	MS/MSD or Laboratory Duplicate imprecision
e	LCSD imprecision	d	MS/MSD imprecision	e	LCSD imprecision
f	Field duplicate imprecision	e	LCSD imprecision	f	Field duplicate imprecision
g	Poor chromatography	f	Field duplicate imprecision	h	Holding time violation
h	Holding time violation	g	Poor chromatography	l	LCS recovery failure
i	Internal standard failure	h	Holding time violation	m	MS/MSD recovery failure
j	Poor mass spectrometer performance	i	Internal standard failure	n	ICS failure
l	LCS recovery failure	l	LCS recovery failure	o	Calibration blank contamination
m	MS/MSD recovery failure	m	MS/MSD recovery failure	p	Preparation blank contamination
r	linearity failure in initial calibration	q	No valid quantitation column	r	Linearity failure in calibration or MSA
s	Surrogate failure	r	linearity failure in initial calibration	s	Serial dilution failure
t	Tuning failure	s	Surrogate failure	v	Post-digestion spike failure
w	Identification criteria failure	u	No confirmation column	x	Field blank contamination
x	Field blank contamination	w	Retention time failure	z	Laboratory storage blank contamination
y	Trip blank contamination	x	Field blank contamination	Q	Other - see bottom of data report for explanation
z	Method blank contamination	z	Method blank contamination		
Q	Other - see bottom of data report for explanation	Q	Other - see bottom of data report for explanation		

APPENDIX E

**Summary of Explosive Risks for SWMUs 1b, 1c, and 42
and Geophysical Survey Results for SWMU 42**

SUMMARY OF EXPLOSIVE RISKS

APPENDIX N OF PHASE II RFI REPORT
GROUP A SUSPECTED RELEASES SWMUs
TOOELE ARMY DEPOT

APPENDIX N

SUMMARY OF EXPLOSIVE RISKS

N.0.0.1. UXB International, Inc. an AEC-approved unexploded ordnance specialty company, assisted Montgomery Watson in conducting the RCRA Facility Investigation (RFI) at the Tooele Army Depot North. The scope of UXB's services included the following field activities:

- UXO clearance as required for test pit excavations and soil sampling
- Test pit excavation equipment operation
- UXO clearance, as required for surface and shallow soil sampling
- UXO clearance for soil borings and sampling
- UXO clearance for air-monitoring station installation
- Safety escort for topographic surveys
- Safety escort for geophysical surveys
- Safety escort for x-ray fluorescence surveys
- Decontamination pad construction

N.0.0.2. In addition to providing the UXO-related field services listed above, UXB was tasked with preparing a written evaluation of the explosive risk at each of the SWMUs where potential UXO was present. Brief descriptions of the explosive risks are included in the applicable SWMU-specific write-ups. The remaining portions of this appendix contain UXB's explosive risk assessment report.

SITE SPECIFIC

UXO RISK ASSESSMENT

FOR

TOOELE ARMY DEPOT NORTH

Submitted to:
Montgomery Watson
4525 South Wasatch Boulevard, Suite 200
Salt Lake City, UT 84124

By:
UXB International, Inc.
14800 Conference Center Drive, Suite 100
Chantilly, VA 22021

CMS
A-TEAD
E-7

1.0 Introduction

UXB International, Inc. was subcontracted by Mongomery Watson, Inc. to provide the following services at Tooele Army Depot North (TEADN):

a. Test pit excavation
b. Test trench excavation
c. UXO safety escort for:
   1. soil sampling
   2. surveying
   3. geophysical surveys
   4. soil borings
d. Site Safety Officer
e. Decontamination Pad construction

During the performance of these tasks unexploded ordnance (UXO) and uncased explosives were located, moved out of the work sites, and Tooele Range Control personnel were notified of their location for final disposition. UXO clearance was a **secondary** function of all the above tasks, therefore specific details concerning the ordnance were not recorded (condition, latitude and longitude found, surface or subsurface).

The following UXO risk assessment deals with the ordnance items found at TEADN in a general manner. Specifics such as lowered risk due to the item being found at six inches vs. on the surface or lowered risk due to the item being incomplete, such as missing part of the explosive filler were not considered.

1.1 SWMU 1 Main Demolition Area (includes SWMUs 1a and 1d)

During the period of May 27 - July 2, 1992, UXB found the following ordnance types and uncased explosives in or near the Main Demolition Area Tooele Army Depot North (TEADN):

a. 20mm projectile (76 ea)
b. 40mm projectile (8 ea)
c. 90mm projectile (3 ea)
d. 155mm projectile
e. M42 grenade (2 ea)
f. BLU 3 fuze (35 ea)
g. BLU 3 (4 ea)
h. BLU 26 fuze (3 ea)
i. 2.75 inch rocket warhead
j. TNT supplemental charge
k. Fuze, misc. (35 ea)
l. 4 lb incendiary bomb
m. 25 lb frag bomb
n. unknown ordnance item (2)
o. 10.88 lbs explosive

1.2 Hazards

The following hazards exist with the above types of ordnance:

High explosive detonations can kill, maim, rupture eardrums, or blind personnel exposed to the blast and shock wave. Secondary concern is damage to vehicles and other high value equipment.

Fragmentation of ordnance casings and high velocity movement of rocks and debris can also cause death, maiming, or blindness to personnel and damage to vehicles and equipment.

Fire inherent to or started by the explosion can also injure personnel and destroy equipment

1.3 Safety Precautions

The following safety precautions should be observed in the presence of items 1.1.a - 1.1.o:

> Heat - do not allow heat or flame producing objects near ordnance or explosives. Heat or flame could produce burning and detonation.
>
> Shock - do not kick or throw ordnance or explosives. These items are very shock and impact sensitive. The BLU 3, BLU 26, M42 grenade fuzes and most projectile fuzes are designed with impact as the primary initiating force. If projectile fuzes are designed with other than impact as the primary initiating force, impact is usually a secondary initiating force.
>
> Friction - do not drag equipment or walk with a grinding motion of the feet in areas with ordnance or uncased explosives. Uncased explosives exposed to weather elements and ultraviolet light become more sensitive to friction and impact.

1.4 Risk Interpretation

If the site continues in its present use as a demolition site, it will be restricted to properly trained personnel who are familiar with the safety precautions listed in 1.3 and who are trained to recognize ordnance and explosives.

Should this site be designated as lease grazing land or have the potential for cattle to stray into the area, the hazards listed in 1.2 would endanger ranchers tending the cattle or rounding up stray cattle. If the ranchers were on foot (outside of a vehicle or off horse-back)in the main demolition area they would be in greater danger due to closer proximity to the hazardous items and less barrier protection offered by a vehicle or horse.

1.4 Recommendations

a. Continue to restrict access to the Main Demolition Area to ordnance personnel employed by TEADN.

b. Provide UXO clearance of any work or sampling sites prior to performing environmental field activities in the MDA.

c. Prior to releasing the land for grazing, perform ordnance clearance on 100% of the area to a depth of 12 inches.

2.0 SWMU 1b Burn Pad

During the period of August 4 - 6, 1992, UXB found the following ordnance types and uncased explosives in or near SWMU 1b, Burn Pad, Tooele Army Depot North (TEADN):

a. 6 oz explosives (1 oz to 2 oz pieces)
b. Projectile fuze

2.1 Hazards

The following hazards exist with the above types of ordnance:

High explosive detonations can kill, maim, rupture eardrums, or blind personnel exposed to the blast and shock wave. Secondary concern is damage to vehicles and other high value equipment.

Fragmentation of ordnance casings and high velocity movement of rocks and debris can also cause death, maiming, or blindness to personnel and damage to vehicles and equipment.

Fire inherent to or started by the explosion can also injure personnel and destroy equipment.

2.2 Safety Precautions

The following safety precautions should be observed in the presence of items 2.a and 2.b:

Heat - do not allow heat or flame producing objects near ordnance or explosives. Heat or flame could produce burning and detonation.

Shock - do not kick or throw ordnance or explosives. These items are very shock and impact sensitive. Most projectile fuzes are designed with impact as the primary initiating force. If projectile fuzes are designed with other than impact as the primary initiating force, impact is usually a secondary initiating force.

Friction - do not drag equipment or walk with a grinding motion of the feet in ares with ordnance or uncased explosives. Uncased explosives exposed to weather elements and ultraviolet light become more sensitive to friction and impact.

2.3 Risk Interpretation

If the site continues in its present use as a burn pad, it should be restricted to properly trained personnel who are familiar with the safety precautions listed in 2.2 and who are trained to recognize ordnance and explosives. Since this site is used as a burn pad, there is a danger even to trained personnel who may detonate shallow, subsurface ordnance by starting fires on top of the buried ordnance.

Should this site be designated as lease grazing land or have the potential for cattle to stray into the area, the hazards listed in 2.1 would endanger ranchers tending the cattle or rounding up stray cattle. If the ranchers were on foot (outside of a vehicle or off horse-back)in the main demolition area they would be in greater danger due to closer proximity to the hazardous items and less barrier protection offered by a vehicle or horse.

2.4 Recommendations

a. Continue to restrict access to SWMU 1b Burn Pad to ordnance personnel employed by TEADN. These personnel should conduct a surface and subsurface UXO clearance prior to building fires in this area to avoid unintentionally detonating ordnance.

b. Provide UXO clearance of any work or sampling sites prior to performing environmental field activities in the Burn Pad site.

c. Prior to releasing the land for grazing, perform ordnance clearance on 100% of the area to a depth of 12 inches.

3.0 SWMU 1c Trash Burn Pits

During the period of August 6 - 11, 1992, UXB found the following ordnance types and uncased explosives in or near the Trash Burn Pits, Tooele Army Depot North (TEADN):

a. 75mm projectile
b. 81mm mortar
c. 90mm projectile
d. 105 mm projectile
e. BLU 4
f. BLU 4 fuze
g. 3.5 inch rocket fuze
h. 5.0 inch rocket fuze
i. Projectile fuze, with booster
j. M557 PD fuze
k. Non-electric blasting cap
l. Anti-tank mine
m. Anti-tank mine fuze
n. Flare, M125

o. Signal cartridge
p. 18 oz of explosives (1 oz - 8 oz pieces)
q .30-06 small arms round

3.1 Hazards

The following hazards exist with the types of ordnance listed in a. through p:

High explosive detonations can kill, maim, rupture eardrums, or blind personnel exposed to the blast and shock wave. Secondary concern is damage to vehicles and other high value equipment.

Fragmentation of ordnance casings and high velocity movement of rocks and debris can also cause death, maiming, or blindness to personnel and damage to vehicles and equipment. Item q., the small arms round, could cause blindness or other trauma if struck directly on the primer.

Fire inherent to or started by the explosion can also injure personnel and destroy equipment.

3.2 Safety Precautions

The following safety precautions should be observed in the presence of items 3.a - 3.q:

Heat - do not allow heat or flame producing objects near ordnance or explosives. Heat or flame could produce burning and detonation which is likely if this site continues to be used as a trash burn site.

Shock - do not kick or throw ordnance or explosives. These items are very shock and impact sensitive. The BLU 4 fuzes, rocket fuzes and most projectile fuzes are designed with impact as the primary initiating force. If rocket and projectile fuzes are designed with other than impact as the primary initiating force, impact is usually a secondary initiating force. The non-electric blasting cap is extremely sensitive to shock and heat and though it has a small net explosive weight (NEW) it is the most hazardous item found on this site.

Friction - do not drag equipment or walk with grinding motions of the feet in areas with ordnance or uncased explosives. Uncased explosives exposed to weather elements and ultraviolet light become more sensitive to friction and impact.

3.3 Risk Interpretation

If the site continues in its present use as a trash burn site, it should be restricted to properly trained personnel who are familiar with the safety precautions listed in 3.2 and who are trained to recognize ordnance and explosives. Since this site is used to burn trash, there is a danger even to trained personnel who may detonate shallow, subsurface ordnance by starting fires on top of the buried ordnance.

Should this site be designated as lease grazing land or have the potential for cattle to stray into the area, the hazards listed in 3.1 would endanger ranchers tending the cattle or rounding up stray cattle. If the ranchers were on foot (outside of a vehicle or off horse-back)in the Trash Burn Pit area they would be in greater danger due to closer proximity to the hazardous items and less barrier protection offered by a vehicle or horse.

3.4 Recommendations

a. Conduct a surface UXO clearance as soon as possible to remove the sensitive items such as blasting caps and fuzes.

b. Continue to restrict access to the Trash Burn Pits to ordnance personnel employed by TEADN. These personnel should conduct a surface and subsurface UXO clearance prior to building fires in this area to avoid unintentionally detonating ordnance.

c. Provide UXO clearance of any work or sampling sites prior to performing environmental field activities in the Trash Burn Pits area.

d. Prior to releasing the land for grazing, perform ordnance clearance on 100% of the area to a depth of 12 inches.

FOOTNOTE FOR TRASH BURN PIT AREA:

The following additional recommendation applies to this area only: Conduct UXO clearance to establish burial locations of 4.2 inch mortars with possible liquid FS smoke or blister agent.

During test pit excavation in Trash Burn Pits 4.2 inch mortars were uncovered. Due to the possiblity of the mortars containing blister agent, UXB was instructed to discontinue excavation in that pit area. The type of filler is unknown, but the fuzing was used on both FS smoke and blister agent.

SITE SPECIFIC
UXO RISK ASSESSMENT
FOR
SWMU 42
TOOELE ARMY DEPOT NORTH

Submitted to:
Montgomery Watson
4525 South Wasatch Boulevard, Suite 200
Salt Lake City, UT 84124

By:
UXB International, Inc.
14800 Conference Center Drive, Suite 100
Chantilly, VA 22021

CMS
A-TEAD
E-15

SWMU 42 GEOPHYSICAL SURVEY RESULTS

APPENDIX F OF PHASE II RFI REPORT
GROUP A SUSPECTED RELEASES SWMUs
TOOELE ARMY DEPOT

APPENDIX F

SWMU 42 GEOPHYSICAL SURVEY RESULTS

F.1 INTRODUCTION

F.1.0.1. During Phase II field sampling conducted in October 1993, Montgomery Watson field personnel encountered surface debris resulting from waste disposal activities at the demilitarization furnaces previously located at the Bomb Washout Building (SWMU 42) and other nearby furnace operations. To explore the possibility that generated wastes may previously have been disposed of (buried) in this area, a geophysical investigation was conducted using soil conductivity, portable magnetometer, and non-ferrous metal detection methods. The investigation encompassed an approximately 800-foot by 2,000-foot (37-acre) area of open field near the Bomb Washout Building (Building 539) during the period of April 16 to May 3, 1994.

F.1.0.2. Presented in this appendix is the final summary report of this geophysical investigation prepared by Practical Geophysics, Inc. of Salt Lake City, Utah. The report consists of an introduction, a description of the methodology and field procedures, and a discussion of results. Appended to the report is a listing and location of subsurface anomalies, and surface items and disposal areas encountered by the geophysical crew. These features are located both by geophysical search grid coordinates and by bearings and distances from an established survey point. The latter method will allow these features to be located at any future time, should a cleanup operation be deemed necessary.

F.2 SCOPE OF GEOPHYSICAL INVESTIGATION

F.2.0.1. The scope of the geophysical investigation at SWMU 42 consisted of the following activities:

- Setting up a search grid over the investigation area to allow east-west traverses to be completed on 15-foot centers.
- Using a GEM Systems model GSM-8 portable field magnetometer, in conjunction with a field non-ferrous metal detector, to conduct a sweep of the area along the east-west traverses.

- Using a Geonics Ltd. Model EM-31 soil conductivity measuring system to search for contrasts in soil conductivity between undisturbed native soil and the disturbed soil associated with any burial features that might be present.

- Flagging subsurface anomalies and any surface items of interest encountered (i.e., significant area of debris, ordnance items, surface mounding, etc.).

- Using a total station surveying instrument to turn angles and set distances from a set reference point to establish the locations of the surface and subsurface features, and construct a comprehensive map of the investigation area showing these features.

F.3 SUMMARY OF RESULTS

F.3.0.1. The results of the geophysical activities at SWMU 42 are summarized as follows:

- A total of approximately 100,000 feet of geophysical traverses were completed during the investigation, and more than 300 individual anomalous features were discovered.

- Most of these features were on the surface, such as metallic debris piles.

- Surface anomalies included both inert and live small and large caliber ammunition, two inert hand grenades, several (probably) inert cluster bomblets, and multiple directional anti-personnel rounds.

- Six locations were staked for subsequent test pit excavation based on the geophysical results.

TOOELE ARMY DEPOT - NORTH AREA

SWMU 42 - GEOPHYSICAL INVESTIGATION

For: Montgomery Watson

By: Practical Geophysics, Inc.

May 1994

PRACTICAL GEOPHYSICS, INC.

1634 WINDER LANE
SALT LAKE CITY, UTAH 84124
TELEPHONE: (801) 277-1844

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PRACTICAL GEOPHYSICS, INC.

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LIST OF ILLUSTRATIONS

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_NTRODUCTION

Geophysical investigation of SWMU 42 was conducted to help evaluate the extent and type of hazardous waste occurances at this site. The initial proposed geophysical work was designed to detect and delineate possible waste disposal pits or trenches. Following the discovery of live ammunition lying on the surface the geophysical work was modified to include a thorough sweep of the immediate surface area for metal waste. Non-hazardous surface debris was to be cleaned up by geophysical survey personnel. The detection and partial delineation of over 300 sites with anomalous geophysical signatures within the search area precluded any attempt to clean up the large amount of associated source material. In particular, the discovery of live rounds of ammunition, hand grenades, cluster bombs, etc., requires cleanup procedures beyond the capability of the geophysical survey crew.

This report describes the methodology and field procedures used for the geophysical investigation and results of this investigation.

GEOPHYSICAL METHODOLOGY AND FIELD PROCEDURES

The approximate 38-acre SWMU 42 area was searched using three separate geophysical methods to detect the following possible occurances; surface/ near-surface metal (both ferrous and non-ferrous), soil conductivity `nomalies associated with burial of metallic and non-metallic waste to a epth of 12 feet and buried magnetic scrap iron and steel to a depth of 10 to 15 feet, depending upon the volume of scrap material. The respective geophysical search techniques were electromagnetic small search coils for individual metal items on or in the near-surface, the EM-31 soil conductivity system to search for relatively large volume burial pits and trenches, and a Gem Systems, Model GSM-8 proton precession magnetometer to detect relatively large volumes of buried scrap iron or steel. The use of these three methods provided a degree of redundancy, which, along with substantially 100 percent coverage of the area, insured the detection of essentially all possible anomolous occurances, from near-surface, single-round, small-caliber ammunition to conductive or magnetic waste material in disposal pits.

A search grid origin was established 30 feet N70°W from the NW corner (reference fence corner) of a chain link fenced compound located approximately 450 feet N20°E of Building 539, (see Plate I). Rather than record individual measurements at specific grid points, N-S grid lines spaced 15 feet apart were surveyed at a slow walk by sweeping the instrument sensors side-to-side in an arc across the grid line. This method allowed for essentially total search coverage requiring the least amount of field time. When an anomalous reading was displayed by any of the three instruments, the other two instruments tested the same site to confirm the anomalous reading. The site would be visually inspected for surface evidence of anomalous material and flagged using red, orange, yellow or blue pin flags. This continuous, as opposed to spot, measurement method precluded the recording of sets of gridded geophysical values. The search objective was to detect and delineate solid waste sites, not produce contoured sets of geophysical data. Efficiency and thoroughness of the investigation were accomplished at the expense of contour maps.

DISCUSSION OF RESULTS

The purpose initially designed for the geophysical investigation was to locate and delineate at least four anomalous sites, which were to be sampled for their chemical content. Preliminary visits to the SWMU 42 area resulted in the discovery of numerous occurances of small caliber ammunition lying within the area. The geophysical search parameters were modified to include a search for surface/near-surface metal (ferrous and non-ferrous) and instructions to conduct reasonable surface clean-up during the surveys.

A thorough sweep of the area, made with the metal detector and magnetometer, required seven field days to complete. The follow-up EM-31 soil conductivity survey required six field days. The combined results of using the three geophysical methods produced over 300 individual anomalous sites. In some instances the anomalous sites have no surface source material, implying shallow to possibly deep burial. In most all cases the anomalous sites represent numerous to countless anomaly sources, e.g., piles of ammunition rather than single items. In most all cases, the anomalous site centers were determined and flagged, but their areal extents were not fully delineated. In some instances sub-areas are continuously anomalous for several hundred feet, e.g., backfilled old railroad cut grade.

Surface anomalous source material included not only small caliber disarmed munitions but also small and large caliber live ammunition, at least two spherical cluster bombs, several pop-bottle shaped cluster bombs, and two hand grenades. The sheer volume of anomalous material, some live ammunition and other larger ordinance and unknown buried anomalous source material all precluded surface clean-up activity.

A post-survey, on-site meeting of TAD, State and Montgomery representatives concluded that site-clean-up would not be immediately possible and that eventual clean-up would involve a complete and detailed geophysical re-sweep of the area by explosive ordinance specialists.

A final field day was spent surveying the locations of the most significant geophysically anomalous sites, significant in areal extent or anomaly amplitude(s) or both. Plate I shows the locations of these anomalous sites as well as detected and delineated utility lines. The locations of these sites give several choices for follow-up chemical sampling.

Appendix A of this report lists the various sites by index number shown on Plate I and describes the site characteristics. The site coordinates listed in Appendix A are measured from the search grid origin. Appendix B also lists the sites by index number, but gives the bearings and distances to the individual sites from the instrument base shown on Plate I. The instrument base is located 510 feet N70°W from the reference fence corner. This base site was selected since the entire search area can be surveyed from this vantage point. Bearing angles were measured clockwise from a reference bearing of zero degrees between the instrument base and the reference fence corner.

Coordinates for (bearings and distances to) the remaining 300 plus anomalous sites were not established since future clean-up will require a thorough sweep and clean-up of the entire area.

APPENDIX A

(See site map showing anomaly locations)

ANOMALY SITE DESCRIPTIONS AND LOCATIONS

TAD-North Area, Bldg. 539(SWMU 42) Geophysical Investigation

ANOMALY SITE #	SEARCH GRID COORDINATES (in feet)	DESCRIPTION OF SITE
1	W383,N 168	Underground cable NW-SE
2	W380,N 265	Intersection overhead powerline & underground waterl:
3	W299,N 207	3 piles 50 cal. slugs 15' dia. area
4	W126,N 97	Piles 50 cal. slugs 10' dia. circle
5	W111,N 106	Utility box
6	W 7,N 67	Melted lead & casings pile
7	E109,N 60	Intersection waterline & underground cable
8	E261,N 33	Intersection underground cable & utility
9	E328,N 66	Mag 300 gammas N-S road
10	E367,N 62	Ash & charcoal pile
11	E393,N 64	Power pole
12	E372,N 90	Several piles slugs-ash-charcoal 20' dia. area
13	E340,N 102	Lead pile
14/13*	E387,N 170	Intersection RR tracks & waterline
15/14	E326,N 183	Mag 500 gammas slugs,misc. iron 25' dia. circle
16/15	E300,N 188	Mag 150 gammas N-S road, slugs
17/16	E327,N 258	RR crossing
18/17	E276,N 283	2 piles slugs ash-charcoal
19/18	E216,N 337	2 piles casings sm. cal.
20/19	E158,N 246	50 cal. slugs
21/20	E 60,N 239	Underground utility EM-40 mmhos
22/21	E 45,N 237	Mag 300 gammas
23/22	W 74,N 376	Underground tuility EM-40 mmhos S. edge road
24/23	W398,N 321	Waterline EM-30 mmhos S. edge road
25/24	W508,N 298	Intersection RR tracks & overhead powerline
26/25	W584,N 241	Intersection RR tracks & underground cable
27/26	W834,N 50	Intersection RR tracks & new telephone line
28/27	W777,S 21	Old telephone post
29/28	W715,S 66	Large brass casings 75,105-155 mm?
30	W580,S 197	Pond dam Mag 300 gammas
31	W526,S 225	Ctr. of pond
32	W605,S 478	N. end trench Mag 600 gammas EM-10 mmhos
33	W594,S 590	Ctr. N-S trench
34	W583,S 712	S. end trench Mag 500 gammas
35	W614,S 896	Cluster bomb (?) yellow
36	W622,S 980	RR cut barb. wire 50'N
37	W569,S1140	RR cut Mag 400 gammas EM-10 mmhos
38	W728,S1159	Old telephone line
39	W706,S1468	Telephone cable box
40	W659,S1524	Storm drain manhole
41	W491,S1400	Intersection RR cut & drain line
42	W470,S1472	RR cut Mag 1000 gammas EM-5 mmhos
43	W449,S1538	RR cut Mag 400 gammas
44	W380,S1529	Mag 800 gammas EM-10 mmhos (15'dia.area pit?)
45	W328,S1546	Mag 700 gammas

*flags numbered out of sequence

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Cont'd.

ANOMALY SITE #	SEARCH GRID COORDINATES (in feet)	DESCRIPTION OF SITE
46	W321,S1268	Sewer (?) manhole
47	W385,S1063	M-1 30 cal.clip full live ammo at 3 stakes
48	W463,S 982	Sm. hills Mag 500 gammas 100' dia. area wooden lids misc. metal
49	W443,S 859	Sm. hill Mag 400 gammas
50	W461,S 693	Sm. hills, lids-misc. ammo casings-ash 50'dia.circle
51	W371,S 682	Live ammo area
52	W366,S 786	Live ammo area
53	W348,S1088	Lead-numerous piles slugs & casings
54	W165,S1153	Piles slugs & casings 200' dia. circle
55	W 57,S1197	RR tracks & 0+00W 12+00S on grid slugs & casings to W
56	W102,S 777	Mag 250 gammas
57	W 75,S 673	Mag 500 gammas misc. metal
58	W 26,S 687	Water valve west edge of marine compound
59	W156,S 600	Misc. metal
60	W265,S 606	Live ammo M2 carbine? 25 cal.
61	W387,S 551	Live ammo 30 cal.
62	W378,S 404	Slugs in & under tar
63	W398,S 303	Cluster casings & slugs 50' dia. circle
64	W409,S 268	Drainage ditch
65	W298,N 51	Waterline EM-10 mmhos Mag 250 gammas
66	W250,S 53	Large lead pile EM-30 Mag 1200 gammas 50' dia. circle castings-nails
67	W254,S 71	Water valve North
68	W248,S 81	Water valve South
69	W190,S 316	Ashes 2' dia. circle
70	W150,S 353	Intersection drainage ditch & waterline
71	W195,S 506	Exploded ordinance site-sandbags-fuse-igniter
72	W 94,S 505	Waterline EM-30 mmhos
73	W 56,S 503	Misc. steel 3' dia. circle
74	W 26,S 391	Waste ditch calvert
75	W 84,S 359	Mag 800 gammas
76	W 43,S 269	Casings 3 stakes
77	W191,S 261	Sm. hill-slugs-drill rig decon area
78	W 36,S 176	Misc. metal 60' dia. circle
79	W 25,S 99	Misc. metal 30' dia. circle
80	W 43,S 82	Ash pile 5' dia. circle
81	W 69,S 27	Ash pile lead 5' dia. circle
82	W114,S 28	Waterline Mag 250 gammas EM-30 mmhos
83	W148,S 67	Metal discs 5' dia. circle

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APPENDIX B

SITE LOCATION BEARINGS AND DISTANCES

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TAD-North Area, Bldg. 539(SWMU 42) Geophysical Investigation

Anomaly Site Location: Bearing and distance from instrument base to anomaly site. Instrument base located 510 feet N70°W from chain link fence corner (see index map).

ANOMALY SITE #	BEARING	DISTANCE (feet)
Instrument Base	0	510
1	299° 55' 35"	194
2	290 45 10	283
3	311 02 45	275
4	344 41 40	367
5	343 57 20	384
6	351 56 55	478
7	354 10 40	592
8	357 29 15	742
9	355 20 20	811
10	355 47 50	849
11	355 49 40	875
12	353 57 15	857
13	352 53 20	826
14	348 53 35	884
15	347 12 30	826
16	346 28 20	802
17	342 14 35	847
18	339 26 20	807
19	334 08 40	773
20	338 57 05	684
21	336 07 50	590
22	335 40 20	576
23	317 13 30	553
24	284 19 30	331
25	264 35 40	299
26	246 43 00	262
27	188 03 00	358
28	175 59 25	298
29	164 11 30	244
30	116 46 20	221
31	101 34 40	230
32	104 40 15	494
33	100 53 35	601
34	98 14 10	719
35	98 28 55	906
36	98 16 05	990
37	94 26 50	1143
38	102 06 00	1185
39	98 45 20	1485
40	96 41 15	1534
41	90 27 19	1400
42	89 37 20	1472

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Cont'd.

ANOMALY SITE #	BEARING			DISTANCE (feet)
43	88°	50'	30"	1538
44	86	15	30	1532
45	84	22	30	1553
46	82	50	30	1278
47	84	54	00	1067
48	89	01	40	982
49	87	30	25	860
50	88	24	12	693
51	80	57	45	691
52	81	45	05	794
53	83	03	35	1096
54	74	42	00	1195
55	70	31	40	1270
56	64	03	00	864
57	58	57	05	786
58	56	33	33	823
59	61	40	50	682
60	70	28	10	643
61	80	25	50	559
62	75	51	35	417
63	74	49	15	314
64	75	02	35	277
65	344	28	28	189
66	13	11	21	236
67	17	21	25	237
68	19	08	57	246
69	47	28	15	429
70	46	59	00	483
71	60	37	41	581
72	52	36	50	636
73	49	54	30	658
74	40	46	25	599
75	42	12	15	535
76	31	38	50	513
77	42	04	15	389
78	21	37	19	478
79	12	12	21	466
80	10	34	10	445
81	3	44	10	412
82	4	20	20	367
83	11	26	45	339

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